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## APPLICATION OF ORCHARD-SPRAYS.

### 1. THE STATIONARY SYSTEM.

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THE stationary system of spraying orchards was first used in America in 1907 (Moses and Duruz, 1926), where it was developed in response to the need for a more rapid and economical method of spraying than was possible with portable outfits. It was not adopted in New Zealand, however, until 1925, in which year it was introduced in the Nelson and Hawke's Bay Districts. The advantages of the system were realized quickly, with the result that to-day it is used widely throughout the fruitgrowing centres of the Dominion.

The essential feature of this system is that the orchard is reticulated with pipes through which the spray is driven from a central pumping-station. Taps are situated at convenient positions along the pipes, and the orchard is sprayed in blocks by attaching a hose to each of these taps in turn. Thus the stationary system consists of two distinct sections (*a*) the piping-system and (*b*) the pumping-station. In the following pages piping-systems are discussed, pumping-stations being dealt with in a subsequent paper.

#### The Piping-system.

For successful spraying by the stationary method it is necessary (1) that the piping-system be carefully planned, (2) that the pipes be properly installed, and (3) that subsequent care and management be such that maximum efficiency is maintained.

##### PLAN OF RETICULATION.

Orchards vary so greatly in size and shape, spacing between trees, distribution of varieties, &c., that no single plan of reticulation is applicable to all. There are, however, two factors—pressure-loss and convenience of working—which influence the reticulation suitable for any particular orchard.

Pressure-loss is caused by frictional resistance to the flow of spray in the pipes. If this is excessive, then either the pump must be run at very high pressure or else insufficient pressure is obtained at the nozzles for efficient mist-production. Pressure-loss is increased by increase in the rate of flow, decrease in the size—*i.e.*, internal diameter—or increase in the length of pipes, alterations in direction by angles

bends, &c., and by internal roughness. In planning the piping-system these factors should be considered with a view to reducing pressure-loss to a minimum.

Convenience of working involves consideration of the plan of reticulation as it affects subsequent spraying operations. A number of factors are significant in this respect, such as the number of trees sprayed from each tap, relationship of the piping-system to different varieties, &c.

### TYPE OF RETICULATION.

When the stationary system was first introduced in New Zealand two types—the dead-end and the circulating system—were used.

Pipes of the dead-end system (Figs. 1, 2, and 3) consist of mains running through the greatest length of the orchard and laterals carrying stand pipes and taps. When the pump is delivering more spray than is required at the nozzles the surplus is returned through a release valve directly to the mixing-tanks.

In the circulating system (Fig. 4) a continuation of the main returns excess spray to the mixing-tanks. The high velocity of spray maintained in the mains of this type of layout was considered necessary to prevent sedimentation of spray solids. Experience has shown, however, that where spray materials of fine-particle size are used the velocity of liquid in the dead-end system is sufficient to prevent sedimentation.

Since the circulating system requires more pipe and causes greater pressure-loss, due to the high velocity of spray in the mains, it has been abandoned in New Zealand in favour of the dead-end system.

### LOCATION OF PIPES.

*Overhead.*—The method adopted in this case is either to utilize the trees for carrying the pipes or to provide upright supports. Neither is satisfactory, for the pipes tend to sag between the supports, causing uneven flow of spray and consequently increased pressure-loss. Further, in this position the pipes hamper picking and spraying operations.

*On the Surface.*—Temporary systems, in which pipes are laid out each time the trees are sprayed, have been used overseas. In New Zealand, however, surface-laid pipes have not been adopted, since temporary systems would prove too wasteful of time and permanent pipes would interfere with routine orchard operations.

*Underground.*—The underground position has been found most convenient, for the pipes do not interfere with general orchard work, and if properly laid and regularly washed after spraying require little attention.

### LAYOUT OF PIPES.

The layout of pipes for any orchard is influenced by the following factors :—

*Location of the Pumping-station.*—In all cases the ideal location for the pumping-station is in the centre of the orchard. In this position pressure-loss is reduced, since the greatest distance from the pump is as short as possible and the nozzle-men can be separated so that they do not all work from the same main (Figs. 1, 2, and 5). In

some cases, however, convenience of working may justify locating the pumping-station at one side. For example, such a position would not materially increase pressure-loss in a long narrow orchard (Fig. 3). A similar position might also be adopted in orchards smaller than 10 acres where pressure-loss is not so significant.

*Direction of the Mains.*—The general layout should be such that the mains bisect the orchard along the longest axes—*e.g.*, Figs. 1 and 2.

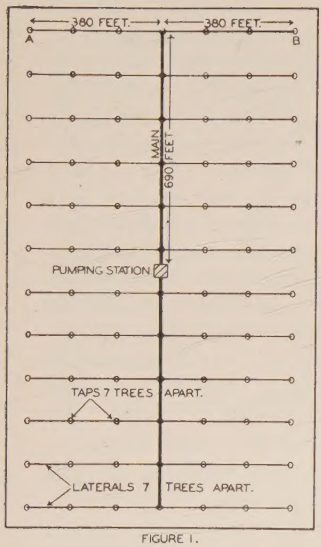


FIGURE 1.

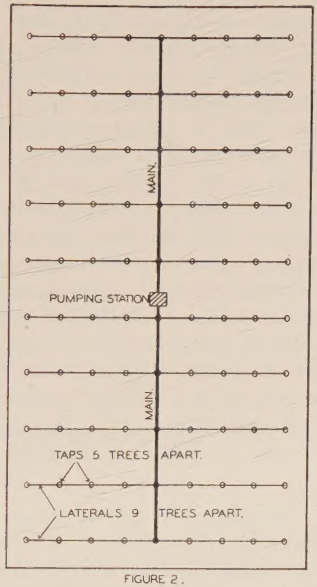
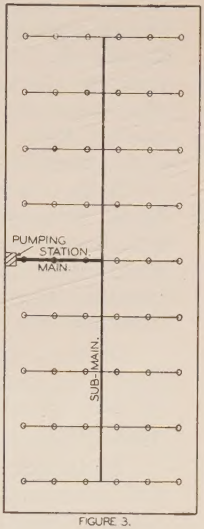


FIGURE 2.



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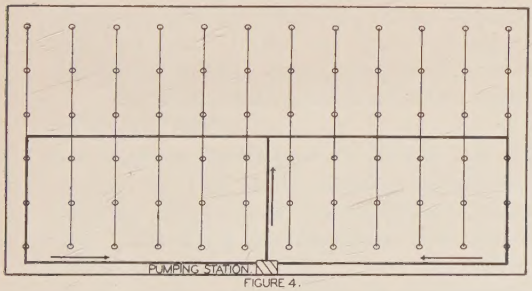

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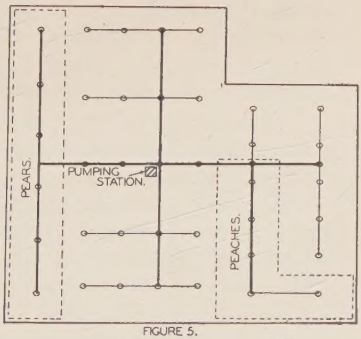


FIGURE 5.

KEY.
MAIN= ——. LATERAL= ——.
TAP= -o-. PUMPING STATION= ▨.

This ensures that laterals are short, thus reducing pressure-loss, since it is in the smaller lateral pipes that frictional resistance is greatest. Further, with short lateral pipes no more than one man need spray from the same lateral.

Where the pumping-station is at the side, one main should run to the centre of the orchard, with submains running along the longest axes (Fig. 3).

*Spacing between Laterals.*—Two methods of piping are in common use—the square and the oblong—depending on the shape of the blocks of trees sprayed from each tap. The spacing between laterals is determined by the method adopted and by the number of trees in each block. In both methods it is usual to place the tap close to the centre tree of each block so that the same number of trees can be reached from each side of the tap. With this arrangement there are necessarily an odd number of trees along each side of the block.

In the square system (Fig. 1) there are seven trees by seven trees in each block, the laterals being spaced seven trees apart. Larger blocks are not advisable, since the length of hose becomes too great to handle efficiently, while smaller blocks have the disadvantage that more frequent changes from tap to tap are required. This applies to orchards where the trees are spaced 18 ft. apart or less. Where the spacing is greater than 18 ft. it is advisable to have blocks five trees by five trees, in which case the laterals will be five trees apart.

In the oblong system (Fig. 2) there are five trees by nine trees in each block, and laterals are spaced nine trees apart. Blocks of trees five by eleven are sometimes used, but the increased length of hose required is too cumbersome for efficient working. Where the spacing between trees is greater than 18 ft. it may be advisable to utilize blocks of trees five by seven with laterals spaced seven trees apart.

Of these two methods the oblong system appears to be preferable, since the greater distance between laterals reduces the total length of pipe required and the blocks of trees are easier to spray (see Management).

*Distribution of Varieties.*—There are usually several varieties of trees in a commercial orchard, and, owing to variations in time of blossoming, susceptibility to spray injury, &c., it is usually necessary to differentiate between varieties when spraying. Thus the piping-system should be planned in relation to those varieties which are likely to require particular spray treatments, otherwise it may be found that frequent changes from one tap to another are required and that considerable lengths of pipe have to be filled in order to spray a few trees.

Varieties requiring particular treatment may be served by introducing additional laterals or by the use of an additional main if one variety runs through the length of the orchard (Fig. 5).

Where a few trees which cannot be sprayed with the main varieties are scattered through the orchard, it is advisable to work them over to a more convenient variety.

## SIZE OF PIPES.

The size of pipes (nominal internal diameter) is determined by pressure-loss, cost, and risk of sedimentation. By increasing pipe-size pressure-loss is reduced, but cost of installation is increased and the risk of sedimentation becomes greater. Under practical conditions, therefore, the size of pipes should be large enough to prevent excessive pressure-loss without involving high cost or risk of sedimentation.

Many of the systems in New Zealand have been installed with pipes which are too small in size, measurements showing that under average conditions pressure-loss may exceed 200 lb., and when the nozzle-men are working from the laterals most distant from the pump it may be

greater than 300 lb. By the use of larger pipes maximum pressure-loss can be reduced to 150 lb. or less without the cost of such pipes becoming excessive or the velocity of spray being reduced sufficiently to cause sedimentation.

In determining the size of pipes which will keep the maximum pressure-loss below 150 lb. the significant factors are the velocity of spray in the pipes and the extent of the piping-system. The velocity or rate of flow is determined by the volume of spray delivered in gallons per minute at the nozzles. For each nozzle (or combination of nozzles) a volume delivery of 3 gallons per minute should be allowed.* From this the maximum velocity in the mains can be calculated by allowing 3 gallons per minute for each nozzle supplied. In the laterals the maximum velocity is 3 gallons per minute, since more than one man should not spray from the same lateral. Table 1 indicates the approximate pressure-loss which is likely to occur under orchard conditions with various sizes of pipes and different rates of flow. Pipe size can be calculated from this table by adjusting the size of mains and laterals so that the maximum pressure-loss is approximately 150 lb. when all the nozzle-men are working on the laterals most distant from the pump. In some cases it may be found unnecessary for all the nozzle-men to work from the same main, in which case the different mains should be treated as separate units and calculations made accordingly.

*Table 1.—Approximate Pressure-loss, in Pounds per Square Inch, per 100 ft. of Pipe.**

| Rate of Flow, in Gallons, per Minute. | ½ in. Pipe. | ¾ in. Pipe. | 1 in. Pipe. | 1¼ in. Pipe. |
|---|---|---|---|---|
| | lb. | lb. | lb. | lb. |
| 3 .. .. .. | 26 | 8 | .. | .. |
| 6 .. .. .. | .. | 25 | 8 | 2 |
| 9 .. .. .. | .. | 52 | 17 | 4 |

* This table is based on measurements taken under working-conditions and includes pressure-loss due to angles, bends, &c.

The use of Table 1 is illustrated as follows: In the piping-system shown in Fig. 1 the length of each main is 690 ft. and each lateral 380 ft. With two men spraying, maximum pressure-loss is experienced when they are working from the taps marked A and B. Allowing a volume delivery of 3 gallons per minute for each nozzle, the rate of flow in the main would be 6 gallons per minute and in each lateral 3 gallons per minute. If ¾ in. mains and ½ in. laterals are used the pressure-loss in the main would be approximately 173 lb. and in the laterals 100 lb., making a maximum pressure-loss of 273 lb. in driving spray to each nozzle. Therefore larger-sized pipes than these are required to reduce the loss to about 150 lb. By substituting 1 in. pipe for the mains the maximum pressure-loss would be approximately 154 lb.

The usual size for laterals is ½ in., but if they are particularly long or far removed from the pumping-station they should be of ¾ in. pipe. Where the mains are short or the velocity of spray is low ¾ in. pipe may

* This figure is based on experimental evidence, which will be published in a later paper dealing with spray coverage.

be sufficient, but if the mains are long or the rate of flow is high they should consist partly or wholly of 1 in. pipe. For extensive systems it may be necessary to use 1¼ in. mains for part of the system.

## ACCESSORY APPARATUS.

*Valves.*—It is advisable to fit a gate-valve on each main close to the pumping-station to shut off sections of the system not in use.

High-pressure taps are used to shut off the flow of spray to the nozzles and to provide attachment for the hose-coupling. These taps are screwed into sockets placed on top of stand-pipes, the latter being connected to the laterals by short underground leads.

*Hose-couplings.*—The usual method of attaching the hose to taps is by a screw-coupling. Another method is to use a coupling on the hose which can be clamped on to nipples permanently attached to each tap. The latter type of coupling has the advantage of easy attachment and removal, but is difficult to keep adjusted and is therefore liable to leak under high pressure.

Valves are sometimes used in conjunction with hose-couplings in order to avoid the necessity of releasing pressure at the nozzles before removing the hose, thus saving time and avoiding wastage of spray. Ball-valves are generally employed for this purpose but are unsatisfactory, for the ball does not seat properly until the coupling is partly removed, by which time the operator has become wet with spray. This difficulty can be overcome, however, by the use of small screw-valves instead of ball-valves.

*Hoses.*—In stationary systems the number of trees which can be sprayed from each tap is limited by the length of hose used. If the hose is too short time is wasted in frequent changes from one tap to another, and if too long it becomes very cumbersome to handle. The maximum length of hose which can be handled efficiently is 120 ft., the actual length required depending on the number of trees to each tap and the spacing between trees.

Two sizes of hose (internal diameter) are commonly used, ½ in. and ⅜ in. Hoses of the latter size are preferable where volume delivery does not exceed 3 gallons per minute, for although the pressure-loss is slightly greater they are considerably lighter to handle.

## INSTALLATION OF PIPES.

The pipes are laid in trenches formed by ploughing furrows and deepening them to from 12 in. to 15 in. For the mains the furrow should lie mid-way between two rows of trees, and for the laterals about 6 ft. from the row of trees to which leads are to be taken for stand pipes and taps.

Pipes are usually supplied in lengths of 20 ft. and these are coupled together with sockets. In joining pipes it is advisable to use bitumistic paint and tow to prevent corrosion and leakage. If all the pipes are connected with sockets it is impossible to remove sections without cutting. Since blockages or leaks may require removal of pipes it is advisable to use running-joints* at intervals throughout the system.

* A running-joint is similar to an ordinary socket joint except that the thread on one piece of pipe is extended far enough to allow the socket to be completely screwed off the companion pipe. The joint is kept tight by a back-nut screwed against packing and the exposed thread painted to prevent corrosion.

Laterals are joined to the mains, and tap-leads to the laterals by tee or cross sockets. Where possible it is advisable to use bends for changing the direction of pipes rather than angle sockets, since with the former there is less pressure-loss.

Stand-pipes are formed by bending the terminal ends of the leads from lateral pipes. They should be as close as possible to the base of their respective trees and extend from 6 in. to 9 in. above the ground. It is advisable to paint them at ground-level to prevent corrosion.

Before covering the pipes the system should be tested to ensure that all the joints are pressure-tight. Finally, an accurate plan of the system should be made marking the exact position of mains, laterals, running-joints, and taps.

## Care and Management.

In determining pipe-size allowance was made for a maximum pressure-loss of 150 lb. when all nozzle-men were spraying from the laterals most distant from the pump. In practice this maximum should be avoided, as far as possible, by separating the nozzle-men so that they are working from different mains and at varying distances from the pump. Whatever arrangement is adopted there are bound to be considerable variations in pressure-loss at different points in the orchard. To obtain relatively constant pressures at the nozzles, adjustment of working-pressure at the pump is required. The amount of adjustment necessary may be ascertained by testing the system at various points with a pressure-gauge inserted between the hose and nozzle.* Necessary adjustments at the pump can then be made during spraying when the nozzle-men reach those positions where tests have been taken.

In spraying the trees from each tap there are two methods of approach. In the first, the operator commences at or near the tap tree, sprays the block of trees in sections so that the hose lies in a diagonal direction when spraying the corner trees, and finishes near to the tap tree (Figs. 6 and 7). The hose is then uncoupled and carried through to the next tap. The second method differs in that the operator commences at one side of the block, sprays the trees in rows, and finishes at the commencement of the next block (Figs. 8 and 9). In this method the operator returns to the tap, uncouples the hose, and pulls the coupling end through to the next tap, the nozzle being left in position for spraying the next block. Both methods vary in detail with nearly every operator, Figs. 6 to 9 serving to illustrate some of the better types in use.

In comparing these two methods it will be seen that the former is complex, involving a large number of turns, while the latter is simple in that long rows of trees are sprayed with a minimum of turns. With the complex method it frequently happens that where the continuity of spraying is broken the operator leaves trees unsprayed. There is little likelihood of this happening with the simple method. The complex method is not readily adjusted to variations in the size

* For this purpose a tee socket may be used with a short upright to carry the gauge and adaptors at either end for attaching the hose and nozzle.

or shape of the blocks of trees, whereas the simple method can be readily adapted. In the simple method long rows of trees are sprayed, and this is well suited to the oblong-block method of piping previously discussed. The complex method has the advantage that a shorter length of hose is used to reach the corner trees, thus making the hose lighter to handle. But this is offset in part by the fact that in the complex system the entire hose has to be carried through to the next tap, whereas in the simple method only the coupling end is pulled

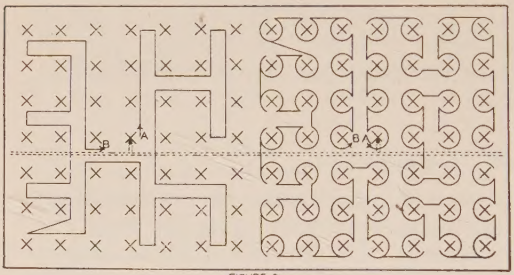
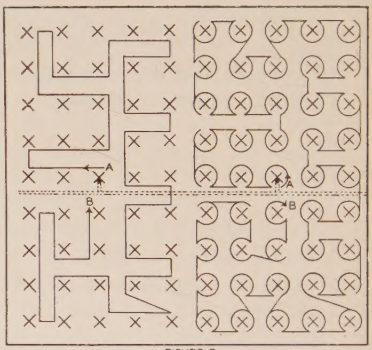


FIGURE 6.



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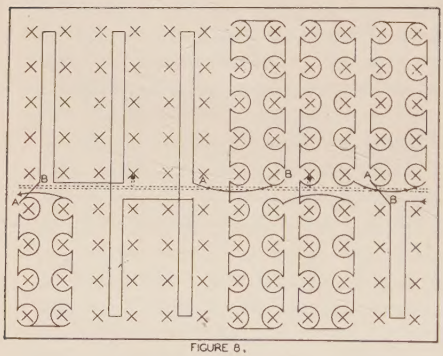

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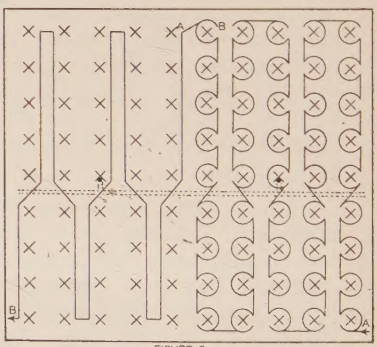

FIGURE 9.

KEY.

TREE = X. TAP = ▪ LATERAL = ——.
PATH OF NOZZLEMAN = (X).
DIRECTION OF HOSE = X X / X X.
COMMENCEMENT OF BLOCK = A.
FINISH OF BLOCK = B.

through. Thus the simple method of spraying the blocks of trees appears to be the better, that shown in Fig. 9 being one of the most efficient types in use at the present time.

Reports from America (Morris, 1924) and experience in New Zealand indicate that corrosion of pipes is extremely slow. In some instances, however, reduction of internal diameter has been caused by accretion of spray materials. This appears to be due partly to the use of spray materials of coarse particle size or of badly emulsified oils and partly to careless washing of pipes. It is desirable, therefore, to wash the pipes with water after each day's spraying, the taps at the

ends of each lateral being opened in turn to obtain the flushing effect of rapid flow. During winter, pipes should be examined and if deposition of spray material has occurred they should be cleaned. Tests have shown that commercial hydrochloric acid used at a strength of 1 gallon to 19 gallons of water makes an efficient cleaning-agent. After leaving the diluted acid in the pipes for half an hour, water should be pumped through until the acid is removed and all loosened material has been washed out.

With proper care the modern type of spray hose will last for five years or more. Damage is likely to occur where the hose becomes twisted and looped. By care in manipulation the hose can be kept free of loops and the liability of "blow-outs" largely avoided. After spraying is completed the hose should be washed inside and out and hung inside the spraying-shed until next required.

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LITERATURE.

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MOSES, B. D., and DURUZ, W. P. (1926): Stationary Spray Plants in California. *California Agric. Expt. Sta. Bull. 406*, 29 pp.

*(To be continued.)*

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# THE OFFICIAL SEED-TESTING STATION.

## RECORD OF TESTING OPERATIONS FOR YEAR 1934.

THE number of samples received for testing averages of purity and germination for the various seeds as specified are shown in the following tables, Nos. 1 to 10:—

*Table 1.—Origin and Classification of Total Samples, 1934 and 1933.*

| Origin. | Purity only. | | Purity and Germination. | | Germination only. | | Ultra-violet Light. | | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | 1934. | 1933. | 1934. | 1933. | 1934. | 1933. | 1934. | 1933. | 1934. |
| Seed-merchants .. .. | **256** | 224 | **6,887** | 8,058 | **4,226** | 4,190 | **249** | 328 | **11,618** |
| Seed-growers and farmers .. | **3** | 3 | **229** | 167 | **50** | 61 | .. | 33 | **282** |
| Department of Agriculture— | | | | | | | | | |
| Fields Division .. .. | **13** | 12 | **119** | 123 | **130** | 67 | **16** | 50 | **278** |
| State seeds-purchasing .. | .. | 1 | **429** | 362 | **99** | 107 | .. | .. | **528** |
| Plant Research Station .. | **4** | .. | **88** | 41 | **333** | 354 | **1,036** | 1,399 | **1,461** |
| Seed-testing Station .. | **53** | 2 | **23** | 188 | **693** | 1,338 | **60** | 14 | **829** |
| Totals .. .. | **329** | 242 | **7,775** | 8,939 | **5,531** | 6,117 | **1,361** | 1,824 | **14,996** |

*Table 2.—Number of Commercial Samples from Land Districts and Centres therein, 1934 and 1933.*

| South Island. | 1934. | 1933. | North Island. | 1934. | 1933. |
|---|---|---|---|---|---|
| Southland (total) .. | **2,942** | 2,887 | Wellington (total) .. | **2,943** | 3,327 |
| Gore .. .. | **1,042** | 1,608 | City .. .. | **1,541** | 1,502 |
| Invercargill .. | **1,652** | 1,219 | Palmerston North and Feilding | **1,006** | 1,420 |
| Other .. .. | **248** | 60 | | | |
| Otago (total) .. | **928** | 1,225 | Other .. .. | **396** | 405 |
| Dunedin .. .. | **829** | 1,010 | Hawke's Bay .. | **873** | 903 |
| Other .. .. | **99** | 215 | Poverty Bay .. | **280** | 360 |
| Canterbury (total) .. | **1,599** | 2,515 | Auckland (total) .. | **843** | 1,016 |
| Christchurch .. | **718** | 1,440 | City .. .. | **675** | 968 |
| Other .. .. | **881** | 1,075 | Other .. .. | **168** | 48 |
| Marlborough .. | **148** | 179 | North Auckland .. | **2** | 56 |
| Nelson .. .. | **11** | 12 | Taranaki .. .. | **198** | 320 |
| Total, South Island | **5,628** | 6,818 | Total, North Island | **5,139** | 5,982 |

*Table 3.—Number of Commercial Samples tested of the various Species of Grasses and Clovers, 1934 and 1933.*

| Species. | Number. | | Species. | Number. | |
|---|---|---|---|---|---|
| | 1934. | 1933. | | 1934. | 1933. |
| Grasses— | | | Clovers— | | |
| Perennial rye-grass .. | **3,510** | 4,005 | White clover .. | **793** | 778 |
| Italian rye-grass .. | **446** | 571 | Red clover .. | **394** | 512 |
| Western Wolths rye-grass | **190** | 200 | Alsike .. .. | **56** | 71 |
| | | | Alsike and white clover | **14** | 17 |
| Cocksfoot .. | **344** | 443 | Subterranean clover | **59** | 40 |
| Crested dogstail .. | **891** | 907 | Strawberry clover .. | **7** | 6 |
| Chewings fescue .. | **887** | 985 | Crimson clover .. | **9** | 20 |
| Brown-top .. | **478** | 380 | Suckling clover .. | **51** | 84 |
| Danthonia spp. .. | **47** | 45 | Lucerne .. .. | **121** | 110 |
| Timothy .. .. | **64** | 84 | Trefoil .. .. | **13** | 28 |
| Yorkshire fog .. | **37** | 70 | *Lotus major* .. | **53** | 82 |
| Meadow fescue .. | **13** | 17 | *Lotus hispidus* .. | **4** | 10 |
| Meadow foxtail .. | **24** | 33 | Other clovers, &c. .. | **12** | 30 |
| Paspalum .. | **61** | 70 | | | |
| *Poa pratensis* .. | **31** | 34 | | | |
| *Poa trivialis* .. | **7** | 12 | | **1,586** | 1,788 |
| Prairie grass .. | **24** | 31 | | | |
| Red-top .. .. | **4** | 3 | | | |
| Miscellaneous grasses .. | **41** | 25 | Cereals, vegetables, &c.— | | |
| | | | Oats .. .. | **38** | 117 |
| | **7,099** | 7,915 | Wheat .. .. | **53** | 71 |
| | | | Barley .. .. | **66** | 81 |
| Roots and other forages— | | | Rye-corn .. .. | **3** | 2 |
| | | | Vetches .. .. | **10** | 1 |
| Swede .. .. | **235** | 247 | Peas (garden and field) | **314** | 265 |
| Turnip .. .. | **334** | 369 | Japanese millet .. | **16** | 15 |
| Rape .. .. | **73** | 148 | Vegetable-seeds .. | **517** | 462 |
| Kale .. .. | **139** | 105 | Flower-seeds .. | **91** | 41 |
| Mustard .. .. | **15** | 23 | Forest-tree seeds .. | **16** | 7 |
| Mangel .. .. | **188** | 186 | Seed mixtures .. | **61** | 10 |
| Carrot (field and garden) | **121** | 104 | Miscellaneous .. | **2** | 36 |
| | **1,105** | 1,182 | | **1,187** | 1,108 |

*Table 4.—Average Percentages of Purity and Germination Capacity for Certified Grass-seed, 1934 (officially drawn Samples).*

| | Purity. | | | | Germination Capacity. | | | | Average Percentage of Pure Germinating Seed. | Number of Samples. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Percentage. | | | | Average Percentage. | Percentage of Samples germinating, in Groups. | | | | |
| | Pure Seed. | Other Crop Seed. | Weed-seed. | Inert Matter. | | Below 80. | 80–90. | 90–100. | | |
| Certified perennial rye-grass— | | | | | | | | | | |
| All samples .. | 98·8 | 0·3 | 0·5 | 0·4 | 88 | 17 | 12 | 71 | 86 | 887 |
| Southland .. | 99·1 | 0·2 | 0·2 | 0·5 | 53 | 92 | 5 | 3 | 52 | 61 |
| Otago .. | 98·6 | 0·1 | 0·4 | 0·9 | 88 | 16 | 25 | 59 | 86 | 12 |
| Central Otago .. | 98·2 | 0·4 | 0·4 | 1·0 | 95 | 8 | 2 | 90 | 93 | 42 |
| North Otago .. | 99·5 | 0·1 | 0·2 | 0·2 | 66 | 64 | 26 | 10 | 65 | 19 |
| South Canterbury | 99·1 | 0·1 | 0·3 | 0·5 | 64 | 73 | 15 | 12 | 63 | 41 |
| Mid-Canterbury | 98·3 | Trace | 0·4 | 1·3 | 83 | 36 | 19 | 45 | 83 | 11 |
| North Canterbury | 98·9 | 0·1 | 0·4 | 0·6 | 88 | 16 | 27 | 57 | 87 | 69 |
| Nelson and Marlborough | 98·6 | 0·1 | 1·6 | 1·5 | 95 | .. | .. | 100 | 92 | 3 |
| Wairarapa .. | 96·8 | 0·2 | 0·5 | 0·7 | 92 | .. | 19 | 81 | 91 | 11 |
| Manawatu .. | 99·3 | 0·1 | 0·4 | 0·2 | 88 | 18 | 36 | 46 | 87 | 72 |
| Wanganui .. | 98·6 | 1·0 | 0·2 | 0·2 | 83 | 40 | 40 | 20 | 81 | 5 |
| Hawke's Bay .. | 98·1 | 0·2 | 1·4 | 0·3 | 94 | 5 | 7 | 88 | 92 | 378 |
| Poverty Bay .. | 98·3 | 0·6 | 0·7 | 0·4 | 95 | 3 | 4 | 93 | 93 | 164 |
| Auckland .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Certified brown-top | 98·3 | 0·1 | 0·5 | 1·5 | 93 | 3 | 9 | 88 | 91 | 124 |
| Certified cocksfoot— | | | | | | | | | | |
| All samples .. | 70·2 | 4·3 | 0·5 | 25·0 | 88 | 6 | 33 | 61 | 61 | 57 |
| Akaroa .. | 70·5 | 4·1 | 0·8 | 25·6 | 89 | 4 | 36 | 60 | 61 | 47 |
| Canterbury (Plains) | 71·2 | 5·2 | 0·6 | 23·0 | 89 | 10 | 20 | 70 | 63 | 10 |

*Table 5.—Average Percentages of Purity and Germination Capacity for Grass-seed other than Certified Seed.*

| | Purity. | | | | Germination Capacity. | | | | Average Percentage of Pure Germinating Seed. | Number of Samples. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Percentage. | | | | Average Percentage. | Percentage of Samples germinating, in Groups. | | | | |
| | Pure Seed. | Other Crop Seed. | Weed-seed. | Inert Matter. | | Below 80. | 80–90. | 90–100. | | |
| Cocksfoot .. | 70·0 | 5·2 | 1·1 | 23·7 | 85 | 15 | 38 | 47 | 59 | 344 |
| Brown-top .. | 95·1 | 0·1 | 0·3 | 4·5 | 85 | 10 | 17 | 73 | 81 | 478 |
| *Perennial rye-grass | 98·3 | 0·5 | 0·6 | 0·6 | 85 | 18 | 20 | 62 | 83 | 1,780 |
| *Italian rye-grass | 99·2 | 0·1 | 0·4 | 0·3 | 89 | 8 | 27 | 65 | 87 | 294 |
| *Western Wolths rye-grass | 98·9 | 0·1 | 0·6 | 0·4 | 88 | 16 | 21 | 63 | 87 | 98 |
| Crested dogstail .. | 96·9 | 2·2 | 0·6 | 0·3 | 73 | 42 | 21 | 37 | 71 | 891 |
| Chewings fescue .. | 96·2 | 0·9 | 0·7 | 2·2 | 78 | 12 | 22 | 56 | 75 | 887 |
| Danthonia spp. .. | 61·9 | 4·3 | 15·7 | 18·1 | 64 | 77 | 23 | .. | 40 | 47 |
| Meadow fescue .. | 97·5 | 0·1 | 1·3 | 1·1 | 63 | 54 | 8 | 38 | 62 | 13 |
| Meadow foxtail .. | 61·7 | 1·7 | 1·9 | 34·7 | 59 | 83 | 17 | .. | 36 | 24 |
| Paspalum .. | 58·6 | 0·3 | 0·1 | 41·0 | 81 | 24 | 51 | 25 | 46 | 61 |
| *Poa pratensis* .. | 85·7 | 0·1 | 0·1 | 14·1 | 77 | 52 | 32 | 16 | 65 | 31 |
| Prairie-grass .. | 94·6 | 0·4 | 0·7 | 4·3 | 70 | 54 | 17 | 29 | 66 | 24 |
| Timothy .. | 99·2 | 0·5 | 0·1 | 0·2 | 91 | 2 | 11 | 87 | 89 | 64 |
| Yarrow .. | 92·5 | 0·6 | 2·2 | 4·7 | 87 | 16 | 28 | 56 | 81 | 43 |
| Yorkshire fog .. | 88·9 | 7·6 | 2·4 | 1·1 | 88 | 14 | 16 | 70 | 79 | 37 |

* Submitted for purity and germination. For germination only, see Table 6.

*Table 6.—Average Germination Percentages for Commercial Samples of Rye-grass tested for Germination only.*

| | Average Percentage of Germination. | Percentage of Samples germinating, in Groups. | | | Number of Samples. |
|---|---|---|---|---|---|
| | | Below 80. | 80–90. | 90–100. | |
| Perennial rye-grass— | | | | | |
| All samples .. | **79** | 32 | 32 | 36 | 1,730 |
| Southern-grown .. | **79** | 36 | 37 | 27 | 1,089 |
| Canterbury-grown .. | **80** | 33 | 25 | 42 | 285 |
| Manawatu-grown .. | **77** | 44 | 30 | 26 | 117 |
| Hawke's-Bay-grown | **89** | 14 | 11 | 75 | 138 |
| Poverty-Bay-grown | **88** | 16 | 7 | 77 | 43 |
| Italian rye-grass .. | **85** | 14 | 39 | 47 | 152 |
| Western Wolths rye-grass | **83** | 27 | 30 | 43 | 92 |

*Table 7.—Average Percentages of Purity and Germination Capacity of Samples of Clover and Related Species.*

| | Purity Percentages. | | | | Germination Capacity. | | | | Percentage of Hard Seed. | Average Percentage of Pure Germinating Seed. | Number of Samples. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pure Seed. | Other Crop Seed. | Weed-seed. | Inert Matter. | Average Percentage. | Percentage of Samples germinating, in Groups. | | | | | |
| | | | | | | Below 80. | 80–90. | 90–100. | | | |
| White clover— | | | | | | | | | | | |
| All samples .. | **89·0** | 8·4 | 1·7 | 0·9 | **78** | 32 | 28 | 40 | 13 | **73** | 793 |
| All certified .. | **88·6** | 7·3 | 1·8 | 2·3 | **89** | 14 | 20 | 66 | 7 | **79** | 60 |
| Hawke's Bay .. | **86·0** | 8·3 | 1·7 | 4·0 | **90** | .. | 15 | 85 | 4 | **82** | 40 |
| Canterbury .. | **95·0** | 1·6 | 2·8 | 0·6 | **84** | 33 | 25 | 42 | 14 | **85** | 12 |
| Other districts .. | **87·1** | 11·1 | 1·2 | 0·6 | **79** | 50 | 38 | 12 | 16 | **73** | 8 |
| Red clover— | | | | | | | | | | | |
| All samples .. | **98·0** | 0·6 | 0·5 | 0·9 | **89** | 13 | 24 | 63 | 7 | **90** | 394 |
| Certified .. | **97·8** | 0·7 | 0·3 | 1·2 | **91** | 18 | 27 | 55 | 7 | **92** | 22 |
| Alsike .. .. | **97·8** | 1·6 | 0·2 | 0·4 | **82** | 29 | 23 | 48 | 8 | **83** | 56 |
| Subterranean clover | **97·6** | 0·1 | 0·1 | 2·2 | **77** | 31 | 47 | 22 | 15 | **80** | 59 |
| Strawberry clover .. | **95·6** | 2·6 | 1·1 | 0·7 | **74** | 70 | 30 | .. | 21 | **78** | 10 |
| Crimson clover .. | **97·7** | 0·1 | 0·3 | 1·9 | **79** | 12 | 13 | 75 | Nil | **77** | 9 |
| Suckling clover .. | **80·9** | 13·8 | 4·8 | 0·5 | **46** | 93 | 5 | 2 | 35 | **45** | 51 |
| Lucerne .. .. | **98·8** | 0·7 | 0·1 | 0·4 | **85** | 21 | 33 | 46 | 6 | **88** | 121 |
| Trefoil .. .. | **95·3** | 2·5 | 0·4 | 1·8 | **88** | 8 | 38 | 54 | 7 | **86** | 13 |
| *Lotus major* .. | **91·2** | 7·5 | 0·9 | 0·4 | **57** | 46 | 44 | 10 | 12 | **55** | 53 |

*Table 8.—Number and Classification of Rye-grass Samples examined under Ultra-violet Light (Trade Samples only).*

| Classification. | Number of Samples. | | Percentage of Samples. | |
|---|---|---|---|---|
| | 1933. | 1934. | 1933. | 1934. |
| A1 .. .. .. .. | 103 | 120 | 31 | 49 |
| A2 .. .. .. .. | 126 | 54 | 28 | 22 |
| A3 .. .. .. .. | 41 | 26 | 12 | 10 |
| B1 .. .. .. .. | 25 | 16 | 8 | 6 |
| B2 .. .. .. .. | 12 | 9 | 4 | 4 |
| B3 .. .. .. .. | 19 | 16 | 3 | 6 |
| B4 .. .. .. .. | 12 | 8 | 4 | 3 |

*Table 9.—Percentage of Samples containing Seeds of Noxious Weeds and Ergot with Approximate Rate of Occurrence.*

| Seed. | Percentage of Samples. | Number of Seeds per Ounce. | Seed. | Percentage of Samples. | Number of Seeds per Ounce. |
|---|---|---|---|---|---|
| *Cirsium arvense* (Californian thistle). | | | | | |
| Crested dogstail .. | 9 | 1–56 | Chewings fescue .. | —1 | 1– 2 |
| Cocksfoot .. | 3 | 3–12 | White clover .. | —1 | 1– 2 |
| Yorkshire fog .. | 3 | 1– 2 | *Lotus major* .. | 4 | 2–14 |
| Italian rye-grass .. | 1 | 2–15 | Alsike .. .. | 7 | 1– 3 |
| Perennial rye-grass | *—1 | 1–10 | | | |
| *Cuscuta* spp. (clover dodder). | | | | | |
| White clover .. | 1 | 9–102 | *Lotus major* .. | 10 | 17–120 |
| Red clover .. | —1 | 1– 2 | *Lotus hispidus* .. | 25 | 1– 14 |
| *Senecio Jacobea* (ragwort). | | | | | |
| Brown-top .. | 3 | 2–1,120 | Italian rye-grass .. | —1 | 1–2 |
| Rye-grass .. | —1 | 1–2 | Yorkshire fog .. | 3 | 1–2 |
| Dogstail .. .. | —1 | 1–2 | *Lotus major* .. | 8 | 1–8 |
| *Chrysanthemum leucanthemum* (ox-eye daisy). | | | | | |
| Timothy .. .. | 2 | 1–2 | Yorkshire fog .. | 3 | 1–6 |
| *Poa pratensis* .. | 10 | 1–2 | Alsike .. .. | 2 | 1–2 |
| *Claviceps purpurea (Ergot sclerotia).* | | | | | |
| Rye-grass .. | 8 | .. | Meadow fescue .. | 58 | .. |
| Chewings fescue .. | 1 | .. | Yorkshire fog .. | 30 | .. |
| Crested dogstail .. | 6 | .. | White clover .. | —1 | .. |
| Cocksfoot .. | 8 | .. | Red clover .. | 4 | .. |
| Brown-top .. | 38 | .. | Alsike .. .. | 2 | .. |
| *Poa pratensis* .. | 10 | .. | Suckling clover .. | 2 | .. |
| Timothy .. .. | 2 | .. | Lucerne .. .. | 1 | .. |
| Italian rye-grass .. | 1 | .. | *Lotus major* .. | 6 | .. |

*— Indicates less than 0·5 per cent.

*Table 10.—Average Germination Capacity of Samples of Cereals, Field Roots, Vegetable, and Flower-seeds.*

*Cereals, &c.*

| | Per Cent. | | Per Cent. | | Per Cent. |
|---|---|---|---|---|---|
| Oats .. .. | 71 | Rye-corn .. | 84 | Blue lupin .. | 79 |
| Barley .. .. | 83 | Maize .. .. | 92 | Tares and vetches | 82 |
| Wheat .. .. | 94 | Japanese millet .. | 90 | Flax (*Linum*) .. | 30 |

*Vegetables, &c.*

| | | | | | |
|---|---|---|---|---|---|
| Beans .. .. | 91 | Endive .. | 90 | Peas (field and garden) .. | 92 |
| Beet .. .. | 78 | Egg-plant .. | 81 | Pumpkin .. | 69 |
| Borecole .. | 86 | Kohl Rabi .. | 91 | Radish .. | 82 |
| Broccoli .. .. | 76 | Kumi Kumi .. | 99 | Sage .. .. | 73 |
| Brussels sprouts .. | 91 | Lettuce .. | 94 | Salsify .. | 48 |
| Cabbage .. | 83 | Leek .. .. | 90 | Savoy .. .. | 93 |
| Carrot .. .. | 69 | Marjoram .. | 62 | Spinach .. | 73 |
| Cauliflower .. | 75 | Marrow .. | 95 | Squash .. | 85 |
| Celery .. .. | 76 | Melon .. .. | 89 | Sweet Corn .. | 92 |
| Chicory .. .. | 66 | Onion .. .. | 76 | Tomato .. | 93 |
| Cress .. .. | 99 | Parsley .. | 55 | | |
| Cucumber .. | 93 | Parsnip .. | 70 | | |

*Root and Forage Seeds.*

| | | | | | |
|---|---|---|---|---|---|
| Swede .. .. | 86 | Kale .. .. | 86 | Mangel .. | 94 |
| Turnip .. .. | 90 | Carrot .. .. | 69 | Mustard .. | 95 |
| Rape .. .. | 94 | | | | |

*Forest-tree Seeds.*

| | Per Cent. | | Per Cent. |
|---|---|---|---|
| *Pinus radiata* .. .. | 65 | *Cupressus macrocarpa* .. .. | 14 |

*Flower-seeds.*

| | Per Cent. | | Per Cent. | | Per Cent. |
|---|---|---|---|---|---|
| Anemone .. | 54 | Dimorpotheca .. | 73 | Poppy .. | 75 |
| Antirrhinum .. | 62 | Gaillardia .. | 53 | Ranunculus .. | 32 |
| Arctobis .. | 12 | Geum .. | 74 | Salvia .. .. | 39 |
| Aster .. .. | 70 | Hollyhock .. | 83 | Stock .. .. | 82 |
| Auricula .. | 22 | Marigold .. | 63 | Sweet peas .. | 95 |
| Calendula .. | 91 | Mignonette .. | 88 | Tagetes .. | 72 |
| Carnation .. | 96 | Nemesia .. | 60 | Tithonia .. | 58 |
| Celosia .. .. | 88 | Pansy .. .. | 47 | Ursinia .. | 62 |
| Clarkia .. .. | 72 | Petunia .. | 91 | Verbena .. | 59 |
| Cosmos .. .. | 81 | Phlox .. .. | 40 | Zinnia .. .. | 81 |
| Delphenium .. | 74 | | | | |

—*Seed-testing Station, Palmerston North.*

# FARMING IN THE AUCKLAND PROVINCE.

## OBSERVATIONS ON FARM-MANAGEMENT METHODS.

P. W. Smallfield, Fields Superintendent, Auckland.

### II. South Auckland and the Lower Waikato Basin.

On the south and east lie ranges of greywacke hills, which are finally extended as islands in the Hauraki Gulf. The Waikato River breaks through this range at Taupiri, flowing north from the Middle Waikato Basin, and enters the Lower Waikato Basin. This lower basin of the Waikato consists of rolling downs of claystone and loosely consolidated sands and silts, containing much volcanic material and low-lying areas, being the swampy flood-plains of the Waikato and its tributaries. Long sprawling spurs reach out into the flood-plain, from which also low rounded hills rise like islands. Lakes are numerous on both sides of the Waikato River, the largest on the east being Lake Waikare (8,461 acres) and on the west Lake Whangape (2,914 acres). The lakes are all shallow, and their surfaces are but little above the normal river-level: the outlets are across the wide swampy flats of the present flood-plain and the edges of the lakes remote from the river are bordered by gently rolling hills(6). The lower basin of the Waikato is bounded on the north and north-west by a basic-volcanic plateau, which is the chief farming district of the area.

The climate of this area is warm and temperate: the prevailing winds are westerly. The mean annual rainfall varies between 45 in. and 50 in. in different localities. Aspect has much to do with climate, and areas sheltered from the westerly and south-westerly winds are warmer and earlier than areas exposed to those winds.

Dairying, pastoral farming, market-gardening, and fruit-growing are the chief farming industries. Dairying is common on the basic-volcanic land, the undulating clay hills, pumice flats, and drained swamps. Pastoral farming consists in grazing Romney sheep and beef cattle on surface-sown hill country—chiefly greywacke and limestone hills, and fat-lamb raising on the basic-volcanic and undulating clay land. Market-gardening—the production of potatoes, onions, and green

vegetables—is carried out fairly extensively on the areas of basic-volcanic soil. Orchards and vineyards are common on the undulating clay hills in the Lower Waikato Basin at Te Kauwhata. Manukau County had 413 acres and Franklin County 163 acres in market gardens, and there were 850 acres in bearing orchards and 83 acres in grape-vines in Manukau, Franklin, Raglan, and Waikato Counties during the 1933–34 season.

MANUKAU COUNTY.

*July 5th, 1935: Mangere, Papakura, Clevedon, Whitford, Manurewa.*—A cold dull day with rain threatening. Pastures on the volcanic land showed quite an appreciable growth—subterranean clover and rye-grass throw quite a lot of winter feed in this district, and the common pasture consists of rye-grass, cocksfoot, paspalum, white and

*Table II.—Crops and Live-stock; Table showing the Area in Annual Crops and Pasture and Numbers of Live-stock in South Auckland Counties, 1933–34 Season.**

| County. | Crops. | | | Live-stock. | | | |
|---|---|---|---|---|---|---|---|
| | Annual Crops. | Pasture cut for Hay and Ensilage. | Pasture. | Dairy Cows. | Other Cattle. | Sheep shorn. | Pigs. |
| | Acres. | Acres. | Acres. | | | | |
| Manukau .. | 1,032 | 9,505 | 104,633 | 29,655 | 17,028 | 74,164 | 7,892 |
| Franklin .. | 5,224 | 27,840 | 191,803 | 81,199 | 42,300 | 60,993 | 33,072 |
| Raglan .. | 4,525 | 8,797 | 302,246 | 34,408 | 56,758 | 308,769 | 11,889 |
| Waikato† .. | 5,293 | 22,716 | 203,712 | 73,020 | 43,856 | 94,666 | 27,901 |
| Totals .. | 16,074 | 68,858 | 802,394 | 218,282 | 159,942 | 538,592 | 80,744 |

* From Agricultural and Pastoral statistics. † Part of Waikato County is in Middle Waikato Basin—figures are for whole county.

subterranean clovers. Hay was everywhere being fed out to milking herds, and at Mangere a very well-constructed haystack cover was noticed—an iron roof made to slide up and down six long posts; similar covers are to be seen in Bay of Islands County, but I have not noticed them elsewhere. There must be a tremendous quantity of hay wasted in the Auckland Province through bad curing and insufficient covering: uncovered stacks are often a third or a half wasted by the middle of winter. Most farmers know how good hay should be made and how essential proper covering is in a wet climate, but farmers are faced with difficulties of labour and finance. The making of good hay usually requires much labour for a short time, and, being only able to work between milkings, dairy-farmers are greatly handicapped. Silage is made more satisfactorily than hay, for the work is independent of the weather, and cutting and ensiling can be regulated by the labour available. Possibly the best hay is made working on the lines of ensilage—only cutting each day what subsequently can be handled and carted in a day. If good cocks are built they will turn a lot of rain. Covering of stacks is best done with corrugated iron, and building nearly flat-topped stacks which are fully roofed with iron on completion appears to be a satisfactory method. A few sheets of iron along the ridge do not really cover the stack, and unless the top is well built water strikes in half-way down the roof and often reaches to the centre of the stack.

Passed a field of prairie-grass that was throwing a lot of feed—excellent feed for winter-milk production. One sees only occasional fields like this one where prairie-grass is dominant; the grass requires a light fertile soil—the red basic-volcanic soils are quite suitable—

SOUTH AUCKLAND, LOWER AND MIDDLE WAIKATO BASIN.
Journey in Manukau, Franklin, Raglan, and Northern Waikato Counties.

and the pasture must be dominantly prairie so that grazing and cutting can be carefully regulated. A few scattered plants of prairie in a mixed pasture are soon eaten out. Many farmers have had disappointing results with special fields of prairie-grass, chiefly through sowing

it on land of not sufficiently high fertility. I once saw a 40 acre field of prairie-grass sown on newly broken-in pumice land near Lichfield (Matamata County): the raw pumice soil was very deficient in nitrogen, and accordingly the prairie-grass plants never grew more than an inch or two high, and very soon died.

The western end of Manukau County consists of an alluvial plain on which are dotted basaltic-lava flows and steep-sided scoria cones; on this land dairying for town-milk supply, market-gardening, and fat-lamb raising are the chief farming industries. The farms are comparatively small and gorse-hedges are common—a relic of early settlement. *Cupressus Lawsoniana* and *C. macrocarpa* chiefly are planted now for hedges and shelter-belts. Town-milk suppliers do not as a rule keep very uniform herds—Friesian and Shorthorn cows appear to be favoured along with cross-bred Jerseys; many herds are maintained by buying in cows ready to calve. The production of early fat lambs is a special activity, and there were a number of lambs already about. To the east the country rises in a series of undulating clay hills, merging into the coastal greywacke hill-range, which is broken by an area of flat alluvial land in the valley of the Wairoa River. The coastal hills have been surface-sown, and are used for sheep and cattle grazing; some Corriedale sheep have been established on this country, and the breed is also used on the islands in the Hauraki Gulf. Some people assert that all the coastal greywacke country on the east coast of North Auckland would be suitable for this class of sheep.

### FRANKLIN COUNTY.

*June 29th, 1934: Papakura to Mercer.*—A cold day with heavy westerly rain squalls—bad weather for live-stock, and store pigs and dry sows which were everywhere roaming over the pastures looked cold and miserable. There has been intermittent rain for the past ten days, and there having been no frosts lately, pasture-growth is exceptionally good for this time of year. Dairy-farmers were everywhere busy feeding out hay and many of them swedes to their dairy herds. Judging by the number of herds with their covers on, there is quite a lot of winter milking being done, partly for town supply and partly for ordinary dairying. Many farmers in this district find it convenient to have the majority of their cows calve in May and June, for on the light volcanic land the winter grass growth is quite good, but pastures dry out badly in the summer. Subterranean clover, which is a good winter grower, is common in the pastures, possibly because of the dry summer soil conditions not being entirely suited to white clover.

Passed a field of green oats, which the farmer was cutting and carting out to milking cows. Green oats are excellent for the winter and early spring supplementary feeding of milking cows, but whether they are worth growing depends on many circumstances. Here, in Franklin County, they are sometimes taken as a catch-crop between a main crop of potatoes dug in March and a succeeding root crop. The inclusion of a cash crop in a supplementary feeding-crop rotation enables catch-crops of green oats to be grown very economically. The potatoes leave the ground in a clean and friable condition, and the oats may be drilled in after potatoes with a minimum of surface cultivation. Sown early on light volcanic land, they make a good

growth by early winter, and are particularly valuable for feeding to early cows in June and July. The growing of green oats is often advocated, but is seldom done nowadays, farmers pinning their faith on permanent grass. Occasionally oats are included in a rotation with swedes; grassland is ploughed in February, land worked down and sown in oats in March, the oats used for feeding in June, July, and August, and the land is reploughed in August or September for swedes.

*July 6th, 1934: Papakura to Awhitu.*—A fine day after rain. The country consists of gently rolling hills of basic-volcanic and loamy clay soils, all in good green pasture. There were many cows in milk, and farmers were everywhere feeding out hay; also large flocks of ewes heavy in lamb and a few lambs, for some flocks here start lambing in June. There were differences observable in pasture-management on farms—here a farm where fields had been shut up and grass-growth saved for early calving cows, there a farm all closely grazed. If grass is to be saved for winter and early spring feeding, supplementary feeding with hay and silage or roots must start in the autumn while the grass is still growing; in short, supplementary feeding must start before it is actually needed.

Visited a small-farm settlement at Awhitu on the south head of the Manukau Harbour. The land is undulating, with a free-working loamy soil, covered by a low growth of manuka and bracken fern; in places the native growth is invaded by a dense growth of hakea. The land had been cleared of manuka and fern, ploughed, summer fallowed, and sown in permanent grass in the autumn (Italian rye-grass, 5 lb.; certified perennial rye-grass, 20 lb.; cocksfoot, 5 lb.; paspalum, 5 lb.; crested dogstail, 3 lb.; red clover, 2 lb.; white clover, 2 lb.; and *Lotus major*, 1 lb.). The land received 10 cwt. of ground carbonate of lime prior to sowing, and the seed was sown with 3 cwt. of superphosphate. Two outstanding things were to be seen in the establishment of the grass—the beneficial effects of a consolidated seed-bed, and of early sowing. Where the land was well consolidated the white clover had struck well, but where consolidation was poor the white-clover establishment was poor. Early March sowings were by far the best: with April sowings the white-clover plants were not sufficiently advanced to withstand the effect of the cold westerly winds direct off the sea.

On the coast there is a narrow belt of sandy country that is used for sheep-grazing, and the pastures consist largely of ratstail. Ratstail on hill country requires heavy stocking with cattle to keep it in the correct stage of growth for sheep. The coarse rank growth is hard and unpalatable, but the young ratstail is quite nutritious, and sheep and cattle thrive on it.

*July 11th, 1934: Papakura to Mercer.*—A fine day after heavy rain; all streams showed marks of having recently been flooded. Lambs were common all over the district, and farmers were everywhere busy feeding out hay, swedes, and mangels to dairy cows. Mangels are often grown on the dairy-farms on the basic-volcanic areas in rotation with potatoes. The mangel seed is sown in beds in September, and after the "second" early potato crop is dug in November the land is ploughed and the mangels are transplanted. The plants, having bulbs about the size of a man's thumb, are pressed into the edge of the newly turned furrow-slice and then covered by the next furrow-slice as ploughing proceeds. Globe varieties are used, and the rows are made

about 20 in. apart. When transplanted in this way very little intercultivation is required. Mangels are also grown after grass. The usual practice then is to skim-plough at the end of winter, plough deeply in November, which gives a thoroughly worked seed-bed, and plough again as the mangels are planted in early December. Care is taken in planting to set the plants at about the same depth as they grew in the nursery beds, and after being covered with the freshly turned furrow-slice the ground is firmed round each plant by the planter's feet. A crop planted in this way in 20 in. rows requires no after-cultivation, and will yield from 40 to 50 tons per acre.

*October 23rd, 1934: Pukekohe.*—A fine day, and the digging of early potatoes on Pukekohe Hill was in full swing: on ground where crops had already been dug the planting of the second crop was under way. On the frost-free ground on Pukekohe Hill two crops of potatoes are grown each year. The first or early crop, which was being dug, is planted in May or June, and the second crop is planted on the same land immediately the first crop is dug. This second crop is dug in February or March, and is often followed by a catch-crop of mustard for green-manuring. Two crops a year may be taken for three years in succession, but the rotation is often varied by growing crops of onions, cabbages, and other garden crops. The early crops are planted in rows 27 in. apart, with the sets 9 in. to 12 in. distant from one another; planting is done after the plough and sets planted and fertilizer broadcasted by hand. For the second crops, which have stronger tops, the rows are usually widened to 33 in. and sets 12 in. to 15 in. apart. Northern Star (Gamekeeper) is almost the only variety grown: it withstands late blight fairly well and suits the double-cropping system. Crops are sprayed regularly for late blight: the plants are generally free from virus diseases, which frequently reduce the cropping-power of potatoes in other districts(7).

The volcanic hill country of Pukekohe and Bombay was originally heavily forested, but all traces of this covering are now gone, and in its place are clean grass pastures, generally divided by live hedges of barberry and of *Cupressus Lawsoniana*. The pastures round Pukekohe were looking extremely well, and here and there were fields which had been closed for ensilage. Early cutting for ensilage is very desirable; it enables good green silage of high-feeding value to be made. Late-cut silage is often brown or black in colour, and late cutting is also undesirable, as the aftermath on the fields is poor.

### WAIKATO COUNTY.

*October 24th, 1934: Mercer to Kopuku.*—The swamp pastures on the flooded areas of the Lower Waitako Basin show many interesting features. The swampy flood-plains of the Waikato River are covered with water for four or five months of the winter, and many of these winter-flooded areas provide valuable summer grazing. Floating sweet-grass (*Glyceria fluitans*) is found where the winter flood-waters are gently moving: it does not extend far into the swamps, where the flood-waters are stagnant. In the winter it floats on the top of the water, and when the flood-waters have subsided the grass assumes its ordinary form and produces an enormous amount of perhaps the most palatable herbage of our grasses. *Paspalum distichum* also thrives under somewhat similar conditions to floating sweet-grass. It grows freely along

the Waikato River and tributaries; it is dormant in the winter, but throws an immense amount of feed in the spring and summer. It throws out long jointed stems which root wherever they touch the earth. The plants have to be propagated by means of cuttings, as the seed does not germinate well. The grass will live for five or six months under water, and when the water starts to go down will grow vigorously. It is an extremely palatable grass and excellent for milk-production and fattening. *Poa aquatica* is a very rank grass which throws a large amount of feed, but is coarse and is not very suitable for dairying, except for dry stock. It will grow for months under water and then "comes away" with great vigour. The leaves look like young raupo leaves and resemble them in general structure, but are much more nourishing. On land that is wet in the winter but not badly flooded are found *Paspalum dilatatum*, meadow foxtail, and *Lotus major*—all very valuable plants. At Rangiriri the flood-waters had subsided, and these marginal swamp summer grazing-areas were making excellent growth. Floating sweet-grass was throwing an enormous amount of feed and *Paspalum distichum* was just breaking into vigorous growth(8).

Leaving these interesting swamp pastures, I travelled on from Rangiriri to Kopuku and examined some recently developed farms on the undulating hills which rise like islands from the swamp. These pastures are now two years old, and pasture-vigour depends on the establishment of white clover. The land is fairly heavy, and was ploughed out of manuka scrub three years ago, worked up and sown in the autumn of 1932. On well-cultivated portions white clover is strongly established, but on dry clay knolls and hillsides white-clover plants are scarce and rye-grass and cocksfoot plants are consequently stunted and poor. Luxuriant white clover is a mixed blessing, and settlers were having a great deal of trouble with cows "blowing" on the vigorous growth of white clover. With the clover the length it is on many of the pastures, the only feasible method of management would be to mow and wilt sections of the grazing-fields each day. When it is mown and wilted the cows relish the feed, and "blowing," if the feed is properly wilted, is overcome. But mowing is not always a satisfactory cure for "blowing," for cows "blow" and die on quite short clover pastures, and in many parts of the Auckland Province white clover causes a considerable mortality in dairy stock. The greatest trouble occurs usually in October, but it may occur at any time if the clover is growing quickly. Hay fed immediately after each milking helps to prevent the trouble.

*October 15th, 1934: Mercer to Taupiri.*—The undulating hills from Mercer to Rangiriri which rise as a long island from the swamps of the Lower Waikato Basin, are devoted largely to fat-lamb raising. At Te Kauwhata are many orchards and vineyards. The land dries out rather badly in the late summer and autumn, and this makes the pasture land more suited to fat-lamb raising than dairying unless paspalum forms an important part of the pasture sward. From Rangiriri to Huntly stretch flats of recently water-borne pumice, beyond which on the south rise the high greywacke hills which separate the basins of the Lower and Middle Waikato. On the foothills of these ranges pastures are being gradually pushed up into the scrub country—mainly surface-sowings following manuka burns. There were numerous patches of felled manuka which will be burnt and grassed in the autumn.

The type of pasture ultimately secured depends on the amount of top-dressing applied. Under regular top-dressing, rye-grass, white clover, dogstail, with some paspalum and brown-top, make a useful pasture, but without top-dressing reliance has to be placed on danthonia and brown-top.

RAGLAN COUNTY.

*July 18th, 1935: Huntly, Rangiriri, Glen Murray, Tuakau.*—A fine morning after rain. Pasture-growth is excellent for this time of year, and early lambs are to be seen on the basic-volcanic areas in the Pukekawa – Onewhero district. The road traversed from Huntly to Rangiriri follows the western bank of the Waikato River, and here the soil and pasture conditions are similar to those already described in the adjacent areas of Waikato County—low rolling hills, flat areas of alluvial pumice, and large swamps. Floating sweet-grass (*Glyceria fluitans*) is throwing much feed on the recently flooded areas, while Indian Doab (*Cynodon dactylon*) appears to be a fairly important constituent of the pastures on the pumice flats, its presence being indicated by a white frosted appearance of portions of the pastures. Indian Doab is a poor grass: it throws some feed in the summer, but is dormant in the winter, and on this land, under higher farming, it should be replaced by rye-grass, paspalum, and white clover. Thick blackberry-patches are common in some of the timbered swamps, and on one field there was a herd of thirty or so goats, kept for blackberry browsing. Where the land cannot be ploughed, the establishment of a paspalum sward is the best means of blackberry eradication. The bushes should be burnt (either after spraying or burning with a flame-thrower) and 10 lb. of paspalum-seed sown in the ashes in November or early December: sown then the paspalum establishes during the summer and forms a turf ultimately to conquer the blackberry.

Farming in Raglan County consists in grazing Romney sheep and beef cattle on the surface-sown hill country, fat-lamb raising, and dairying on the low undulating hills of the Lower Waikato Basin, the basic-volcanic areas in the north of the county, and the alluvial areas in the river valleys of Raglan Harbour. In the south and west of the county is the western or coastal upland, a deeply dissected plateau, and from it in the south rise Mount Pirongia (3,156 ft.) and Mount Karioi (2,420 ft.). The crest of the Hakarimata Range is 1,234 ft., and in the north the elevated areas decline to 1,000 ft. or less. Originally forested, much of this hill country has been felled and grassed and is devoted to sheep and cattle grazing—the limestone country carries the best pastures. On the drier sandstone hills danthonia is the chief pasture-grass, and there is a good deal of reversion to fern and manuka. In the middle east of the county is the western part of the Lower Waikato Basin already described, and in the north-east corner is the basic-volcanic plateau of Pukekawa-Onewhero, which is the most closely settled and highly farmed portion of the county.

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## REFERENCES.

(6) Geological Survey Bulletin, No. 28 (New Series). The Geology of the Huntly-Kawhia Subdivision, Pirongia and Hauraki Division.

(7) J. E. BELL: Early-potato Growing in Franklin County. See this *Journal*, April, 1930.

(8) J. E. BELL: Swamp Pastures in Lower Waikato Basin. See this *Journal*, September, 1935.

# LEMON-CULTURE.

W. K. DALLAS, Citriculturist.

*(Concluded.)*

## PICKING.

Careful handling during picking and carting to the packing-shed is essential to prevent injury to the skin of the lemons. It is necessary for the pickers to wear gloves to prevent scratching of the skin with their finger nails. The lemons should be removed from the laterals with sharp clippers with rounded nose. The stalk should be cut back to a mature bud about an inch and a half from the fruit and then double clipped to remove the stalk and to ensure that it is trimmed level with the button, for unless this precaution is taken the protruding stem-spikes are liable to damage fruits with which they come in contact.

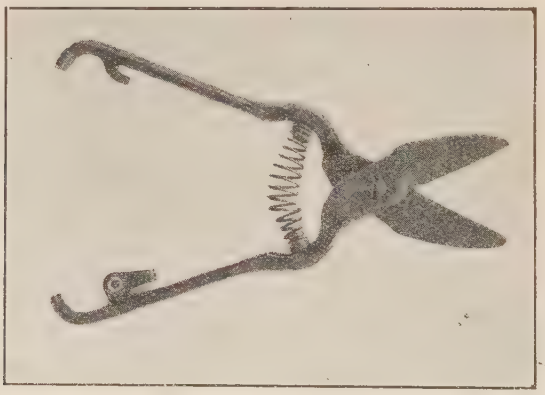

FIG. 4. TYPE OF LEMON-CLIPPER USED IN TAURANGA DISTRICT.

The fruits should not be dropped, but laid in a padded tin or in a picking-bag, which should be so made as to open at the bottom. When sufficiently full the lemons must be carefully transferred to the orchard box, which should not be filled to within more than 1 in. of the top. To roll the fruit roughly into the boxes causes bruising and stem punctures and an ultimate heavy loss, for storage rots usually gain an entrance to the fruit only through injury to the skin.

The orchard boxes should be smooth inside, have no protruding nails, and should be closely boarded on the bottom to prevent the entry of stubble, &c., which may cause injury to the fruit. The boxes should be disinfected prior to each picking in a solution of formalin (40 per cent.), 1 part to 120 parts water.

In orchards where ladder-work is necessary pickers should avoid resting their weight on the picking-bag containing lemons, and, when descending, the fruit should not be allowed to bump against the ladder. Several days should be allowed to elapse after rain before

picking is proceeded with. Fallen fruits should not be placed into the orchard box with the picked fruit, but kept separate. After picking, the fruit should not be left exposed to the sun.

Lemons should be picked when they reach the size desired by the trade, which is approximately 2¼ in. to 2½ in. in diameter. To obtain the finest grade and long keeping they should be picked when they are green or silver-green in colour. Fruit ripened on the tree is usually oversized and coarse, is not amenable to the curing, and is usually disposed of to the factory for the preparation of peel and juice. In order to harvest the lemons in proper condition a picking should be made at least every four weeks, and in some situations once in three weeks is necessary. Growers who do not pick as often as this have in consequence a higher percentage of oversized and yellow lemons than is desired where all the fruit is required for curing.

In loading the wagon care should be taken to see that the fruit has remained below the level of the boxes so that it will not be crushed by the boxes placed on top. The boxes should not be bumped down nor stacked any higher than a person can conveniently reach, which is about six tiers high

## Dipping and Sorting.

After delivery at the packing-shed freshly picked lemons should be stored for three days—this tends to reduce the possibility of skin injury during the dipping and sorting operations.

Prior to colouring and curing the dipping of the fruit in various solutions such as borax and bicarbonate of soda for prevention of green and blue mould has been practised for many years, but the treatment used in most instances have given unsatisfactory control. The borax treatment, using 8 lb. borax to 10 gallons water heated to 110° F., has given the most promise. The fruit should be held in the solution for four minutes, then drained, dried, and placed in clean sterilized trays, which should be lined with clean paper. This treatment should be done in a room with an atmosphere which is free from mould spores.

The trays used to hold fruit in the curing-room should be well washed and then sterilized with formalin (40 per cent.), 1 part to 120 parts water. The trays should be dried thoroughly, stacked, and covered carefully to prevent contamination while awaiting to be used. Mould infection takes place only through breaks in the skin of the fruit. No dip treatment can take the place of careful handling.

The lemons are sorted according to the following colours: (1) Dark green, (2) silver-green, (3) "coloured," and (4) "tree ripe." The first two grades are the best for long keeping; the "coloured" grade under similar conditions usually does not keep as long as the green grades, and should be marketed earlier. The "tree-ripe" class should be disposed of for peel and juice purposes, &c. The fruits of the respective grades should be kept separate throughout on account of the different keeping qualities and different periods required for curing.

## Colouring.

As the majority of lemons are picked green from the tree, colouring is practised to hasten the development of a bright natural lemon colour in the fruits. The colour may be developed by either sweating

FIG. 5. SORTING LEMONS ON ARRIVAL AT THE SHED INTO DARK-GREEN, SILVER, "COLOURED," AND "TREE-RIPE" GRADES.

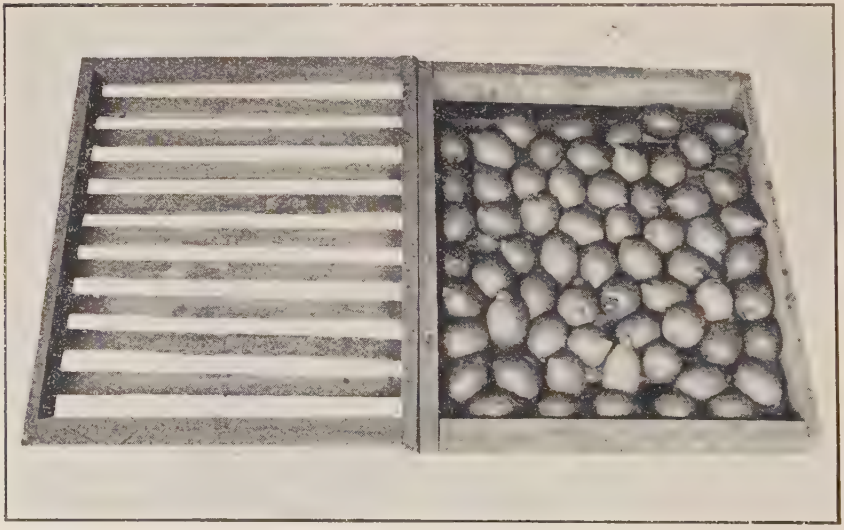

FIG. 6. LEFT: EMPTY TRAY. RIGHT: TRAY FILLED WITH ONE LAYER OF LEMONS.

or by gas treatment. Sweating may be carried out either by storing the fruit in rooms or tents, which should be kept dark or by keeping the fruit covered with thick canvas or other suitable material. The temperature of 70° F. and a relative humidity of 75 per cent. to 80 per cent. should be maintained as nearly as possible for a period which, on the average, is from seven to ten days. Under these conditions the period depends on the degree of colour in the fruit when picked. At a lower temperature the colour will not develop so quickly, while insufficient relative humidity will cause the skin of the fruit to harden and shrivel. To maintain the correct temperature and relative humidity moisture and artificial heat are necessary.

The gas method of colouring lemons is used extensively, either the gas generated from kerosene stoves or ethylene gas being employed. It is stated that the gas treatment somewhat reduces the storage life of the fruit. A room fitted with a door and a window which have been made airtight is suitable for the colouring treatment. The window is necessary for the taking of the temperature and relative-humidity readings. In filling the room the trays, loosely packed with one layer of lemons, should be stacked with 1 in. dunnage between them and with a space between each tier of trays to allow the gas to reach the fruit. A fan or other means of mixing the gas with the air should be installed. The colour continues to develop after the removal of the lemons from the sweating or colouring room.

Paraffin-oil stoves, Perfection B type, or other types fitted with a perforated tin sheet placed on top of the burner to cause incomplete combustion of the kerosene are in use in some countries. A vessel of water is placed on top of at least one of the burners to create the desired humidity. The stoves are placed below the room, and the gas, heat, and moisture pass upwards through a grated floor or in an adjoining compartment from which the gas, heat, and moisture are delivered into the colouring-room by means of a blower. Two stoves are sufficient to colour four hundred cases. In other countries this method is being replaced by the ethylene-gas method, which is cleaner and more satisfactory. Ethylene gas is recommended by the manufacturers for use in airtight rooms at the rate of 1 part of ethylene to 5,000 parts of air. In rooms which leak a higher concentration is necessary. The gas is liberated into the room, from a cylinder with measuring apparatus attached, through an iron or steel pipe. The temperature should be maintained at between 60° and 65° F. and the relative humidity about 80 per cent. Two doses per day, one in the morning and the other in the evening, are injected into the room. The lemons under normal conditions are coloured sufficiently in from four to five days. An essential part of the treatment is to ventilate the room thoroughly for an hour before releasing a fresh dose of ethylene so as to replace the oxygen which the fruit has used and to clear out the old gas. It is stated that where ventilating is neglected the buttons readily fall from the fruit. When the colouring process has been completed the lemons should be sorted to remove those of doubtful keeping-quality. The sound fruit should be washed, dried, and placed in single layers in trays for transference to the curing-room.

### Washing.

The lemons should be washed and gently brushed to improve the appearance of the fruit by removing all adhering dust and dirt. In

brushing lemons, particularly those which have grown quickly, the greatest care must be exercised if injury to the skin is to be avoided. After washing, if no other means of drying is available, the lemons should be dried quickly in an airy shed, preferably in a position between two open doors where a draught of air may continuously pass over them.

## Curing.

Lemon-curing is a term used to indicate a treatment of mild dehydration to which lemons are submitted to improve the quality of the fruit and to extend the period for which it may be kept in sound condition. The treatment causes the skin to become thinner and tougher. The rind of a properly cured lemon should be smooth and soft.

FIG. 7. STACKS OF TRAYS OF LEMONS IN CURING-ROOM (AT TAURANGA).

It is essential during the curing process to maintain a plentiful supply of fresh air. The humidity of the room should not be allowed to fall too low, otherwise the skin of the fruit is apt to shrivel. The relative humidity is determined by means of a hygrodeik, and a reading of 75 per cent. is suitable. An increase in humidity can be effected by sprinkling the floor of the room with water, and some such plan is usually resorted to when the hygrodeik reading falls below 70 per cent.

A cool, even temperature between 40° and 65° F. tends to reduce the liability of green and blue mould-infection in lemons and enables them to be kept longer than those held at other temperatures. If occasion arises, the curing process may be hastened by increasing the temperature, but this should not exceed 75° F. The curing-room should be darkened and draughts avoided.

The stacks of trays should be arranged in blocks with avenues between each block to allow of a free circulation of air. When the trays are being placed on or being removed from the stacks they should be lifted and not pushed or drawn, as this is liable to scrape the fruits on the tray below. The top tray of each stack should be covered with canvas. Cases with one-piece sides or with close-boarded sides are used with satisfactory results by many lemon-growers for curing.

Each colour grade, as determined at the time of sorting of the respective pickings, should be kept in separate blocks, so that the condition of each lot of fruit may be checked regularly to ensure its being marketed when it reaches prime condition. To complete the curing process under normal conditions takes from four to six weeks; very dark-green lemons take from six to ten weeks.

Since mould is usually much more prevalent during the period August–November, the fruit in the curing-room during these months should be examined at least once a fortnight and mould-infected fruits removed. During the remainder of the year examinations should be made at intervals of three weeks. Infected fruit should be handled so as to prevent the spores from being disseminated into the atmosphere of the room. Suitable provision should be made for the disposal of rotten and mould-infected fruits to prevent the spores from entering the atmosphere of the curing and packing shed. Such fruit should be collected in moistened sacks or other suitable receptacles and not placed in open boxes.

The fruit should be held under curing-room conditions until ready for grading and packing prior to shipment.

## Summary of Recommendations relating to Picking and Curing.

(1) Lemons should be picked green, when they reach the size of $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in.

(2) The pickers should wear gloves in order to prevent finger-nail injury to the fruit. Picking should be done by means of a specially designed sharp clipper with rounded nose. The stems of the fruit should be cut in such a way as to avoid injury to the "button" and leave no stem-spikes—this in most instances necessitates double clipping.

(3) The fruit should be picked carefully and laid into a suitable picking-bag, and thence placed in the orchard boxes, which should be well made, closely boarded on the bottom, perfectly smooth, and without protruding nails on the inside. Before use the boxes should be cleaned and disinfected with formalin solution (40 per cent.), 1 part to 120 parts of water.

(4) Orchard boxes should be filled to not more than 1 in. of the top, handled carefully, and conveyed to the packing-house in vehicles fitted with springs, the load being in accordance with the strength of the springs.

(5) In the packing-shed the fruit may be dipped in borax solution, dried, and then sorted into the following colours: dark green, silver-green, "coloured," and "tree-ripe."

(6) The fruit may be coloured by sweating or artificially coloured by means of kerosene-stove fumes or ethylene gas.

(7) The lemons should be washed and then dried before being cured.

(8) The "coloured" grade should be packed and disposed of before other grades of cured fruit.

(9) The curing-house should be of such construction as will maintain even termperature and relative humidity, and ventilated adequately in such a manner as to admit conveniently large supplies of air when required.

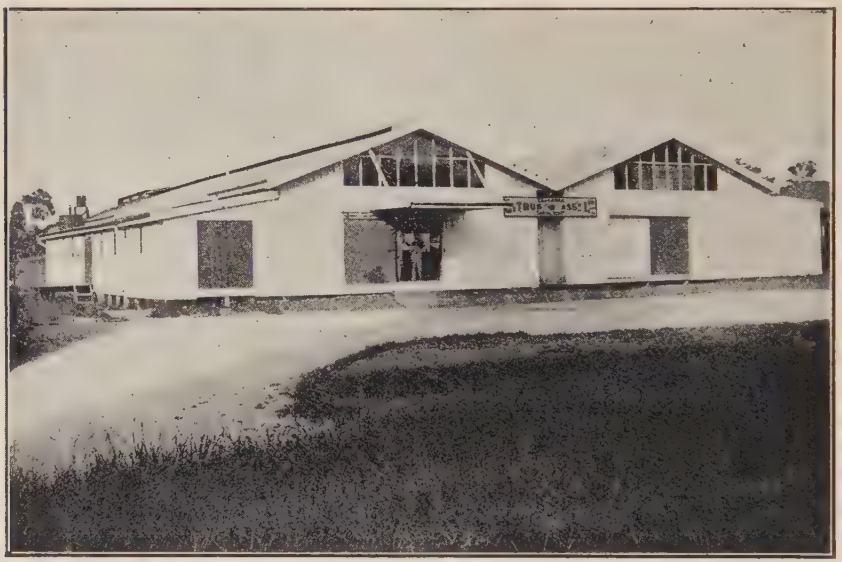

FIG. 8. CURING AND PACKING SHED OF TAURANGA CITRUS ASSOCIATION, LTD., TAURANGA.

(10) Standard grading should be adopted, and particular attention given to eliminating inferior fruits.

## Curing and Packing Shed.

The building should be sufficiently large to enable a full crop to be handled conveniently. Packing-houses are usually built to meet individual requirements in respect to receiving fruit from the orchard for washing, colouring, curing, grading, and packing. Considerable thought should be given to the design and lay-out of the building to ensure easy working and a minimum of handling.

The colouring and curing rooms should be constructed 4 ft. above the ground so as to allow of a sufficient height for the stove-rooms built directly below the colouring-rooms, and to allow for ample ventilation beneath the curing-rooms.

## Grading.

Grading has become a matter of considerable importance owing to the increased competition due to greater quantities of lemons reaching the markets. Faulty grading is detected quickly by the buyers, and only good, carefully graded and packed fruit realize satisfactory prices. The demand is always keener for consignments which have the reputation of being well graded.

The sizing of the fruit, the grading for quality, and the removal of damaged and blemished lemons usually are done by hand. In grading the greatest care must be exercised, and persons handling the fruit should wear gloves. A considerable amount of skill is required to maintain throughout a grade of even standard and of good quality. To meet the need for uniform grades throughout the Dominion official grade standards for lemons will shortly be gazetted.

## Packing.

Growers should bear in mind that their fruit comes in direct competition with that of other growers who have attained a high degree of skill in this work. The pack should be tight and attractive, and to obtain this result the lemons selected for the case should be uniform in size, colour, and quality. There is nothing complicated or difficult about packing, and to become a good packer it is necessary merely to have a knowledge of the fundamental principles, together with practice in the actual operations.

A bulletin dealing with the recognized standard packs for lemons and oranges is about to be prepared.

## By-products.

In all citrus areas there is a proportion of the fruit which is below the quality required by the markets, such as over-large, coarse, and tree-ripened lemons. This class of fruit usually can be disposed of for the making of lemon-juice and candied peel. The manufacture of other by-products such as lemon-oil, pectin, citric acid, and citrate of lime, &c., have not yet been developed in the Dominion.

## Marketing.

There is no doubt that the handling of the lemon crop is a business which urgently calls for co-operation, as it is by this means only that sufficient fruit is likely to be assembled under one control to allow of uniform curing and grading, marketing in prime condition, and a better distribution. While this is a matter for growers to decide, it is very evident that by individual efforts alone the New Zealand lemon industry will take a long time to reach the position it otherwise might attain readily. In this connection it is satisfactory to note the movement towards co-operation in the North Auckland, Auckland, and Bay of Plenty Districts. The formation of the Tauranga Citrus Growers' Association and the evident determination of the growers of that district to standardize and improve their packing, storing, and marketing methods marked the first definite step in this direction.

# HYDATIDS.

## FROM A VETERINARY OFFICER'S VIEWPOINT.*

D. A. GILL, Superintendent, Live-stock Division, Wellington.

THE natural course in "hydatids" is from animal to man—never the reverse.

The hydatid of which we speak is the cystic stage in the life-history of a small tapeworm called *Echinococcus granulosus*, which, unlike most of the common tapeworms, is very small—only about ¼ in. long when fully grown, and only the hinder one of its four segments contains eggs. The small size of this parasite has a significance which seems often to be overlooked. Most farmers and other owners of dogs know that dogs are subject to tapeworm infestation, but the conception of a tapeworm is limited to something like a long piece of white tape that is easily seen. Consequently they tend to assume their dogs are not infested because they do not see obvious worms or segments in the droppings. Moreover, a dog-owner who uses worm-medicine because of the possibility that his dog is infested often forgets the small size of *Echinococcus granulosus*, does not see anything in the motions resulting from the medicine that accords with his idea of a tapeworm, and hence considers his dog is free of them, and that he has merely wasted his time in treating it. Even to the trained eye these parasites are not easily seen in fæces unless they are plentiful and unless the hinder segments are "ripe." The ripe segment is fairly conspicuous as it is white and opaque because of the eggs within it, but otherwise the parasite is fairly translucent, and immature forms particularly are difficult to see. This is a very important point when considering control measures.

Dogs infested with this parasite do not, as a general rule, show any symptoms of it. The small intestine is the part affected, but only when a large number of these tapeworms are present does any obvious illness result, and even a thousand or so cause only vague symptoms. There is a slight enteritis and the dog may be irritable, rather listless, show harshness of the coat and diarrhœa. Diagnosis based on symptoms is, therefore, impossible.

Examination of the animal's fæces for tapeworm eggs is quite simple, and the eggs are easily recognizable as being those of "a tapeworm," but one cannot tell the eggs of *Echinococcus granulosus* from those of other tapeworms with any certainty either by their general appearance or by measurements of size. The Casoni skin-test will not detect infested dogs, and, while a complement fixation test may do so, it is too difficult and unwieldy a method for ordinary use.

For how long one of these parasites can live in the host's intestine and continue shedding off ripe segments is not known, but it is probably a long time. Human beings harbouring *Taenia saginata* have been known to continue passing the eggs in their fæces for years without reinfestation.

Perhaps a more important point is how long the eggs of this parasite, *Echinococcus granulosus*, can survive in the outer world while waiting

* Portion of lecture to Sanitary Inspectors' Association, Wellington.

to be picked up by a secondary host. Research on this point has not been extensive, but it has shown that the eggs survive freezing temperature for four months and possibly longer (Dévé, 1908). Sunlight and dessication destroy them fairly quickly. Ross in Australia found that dessication and exposure to sunlight—the temperature often exceeding that of the human body—destroyed the eggs in three weeks or possibly less, while Dévé, in 1908 (quoted by Ross), found that they withstood dessication for sixteen days, or exposure to bright sunlight for two days, and to dessication for a further nine days. Ross found that kept in moist sand they survived three weeks, but not six weeks. These facts accord with the widely held view that hydatid disease is more prevalent in areas with moderately high rainfall and temperature and less prevalent in hot, dry areas.

A question which is often asked and to which a proper answer is important is whether animals other than dogs can harbour this tapeworm—and particularly whether cats may be infested with it. The domestic dog of any breed seems to be the most favourable host, but natural infection does occur in closely related species such as foxes, wolves, and probably dingos, but these species do not concern New Zealand since they do not occur here. As to the possible infestation of cats, actually there are good grounds for thinking that the cat is at most a very rare host for *Echinococcus granulosus*. In the first place, although very large numbers of cats are subjected to post-mortem examination every year, references to natural infestation with the species of tapeworm are very few, and there have been none for many years. It is always possible that the few recorded cases were, in fact, mistakes. Secondly, it is extremely difficult to infest cats with *Echinococcus granulosus* even when infected flesh is deliberately fed to them freely. Dévé, in 1904, only succeeded with one cat out of five; Ross, in Australia, in 1926, failed entirely; and Southwell, in England, in 1927, managed to establish infection, but the worms failed to mature or to produce eggs. Briefly, the facts are that cats are seldom, if ever, found naturally infected, that they are very difficult to infest experimentally, that even when that is accomplished the parasite seems unable to mature, and, moreover, from the nature of their diet and habits, cats are much less likely to eat food containing cysts than are dogs. To sum up, in New Zealand the only host of *Echinococcus* that is of any consequence is the dog.

Since it is on infestation of the dog with the adult *Taenia* that all further infestation of man and animals with hydatid cysts is dependent, it is advisable to consider briefly the source from which the dog becomes infected.

Virtually, there is only one such source—ingestion by dogs of raw offal from cattle, sheep, and pig carcasses containing *Echinococcus* cysts. Consequently sheep-dogs and dogs about slaughtering-places are very generally infested, since they are so commonly given to eat the raw viscera of slaughtered animals—and the more abnormal a liver, for instance, looks, the more likely is it to be thrown to the dogs, since it is not considered fit for human food. These things being so, one would imagine that such dogs would be much more commonly infested with *Echinococcus granulosus* than would the ordinary pet dog, and

this is, in fact, the case. Ross in New South Wales demonstrated this important point very well in his work on hydatids. His results speak for themselves and are as follows :—

| Class of Dog. | Number examined. | Number infested. | Percentage. |
|---|---|---|---|
| Farm and station .. .. | 18 | 7 | 39·0 |
| Slaughterhouse .. .. | 36 | 11 | 30·5 |
| City of Sydney .. .. | 100 | 0 | 0·0 |
| Rabbiting dogs .. .. | 20 | 0 | 0·0 |

From this it is clear that the dogs receiving, or having access to, raw offal from sheep, cattle, or pigs are the ones likely to harbour the *Echinococcus*. It also demonstrates the error of the old belief that rabbits are among the intermediary hosts of the parasite. (The cysts found in rabbits are, of course, *Cysticerus pisiformis*, the cystic stage of *Taenia pisiformis* in the dog, a tapeworm that has no significance whatever, for human health, and *Coenurus serialis*, which is the cystic stage of another dog tapeworm, *Multiceps serialis*, also without significance for man.) Investigations in New Zealand have tended to confirm the Australian findings.

It must not be assumed from this that only country dogs are to be reckoned with. Pet dogs are not infrequently fed on raw livers and lungs, and if these come from an ordinary slaughterhouse where no Meat Inspector is stationed, a small cyst may be present, unknown to the slaughterman and quite unsuspected by the dog's owner. Moreover, town dogs are often taken away to stay on farms in the country, and may become infested while they are there on holiday.

The chances of a dog contracting infection by ingesting raw offal depends on the extent to which cattle, sheep, and pigs harbour the cystic stage. The age of the animal is an important factor in this since in all observations that have been made it has transpired that the older the animal the more likely is it to be infested. Probably the most careful survey ever made regarding hydatid incidence in animals was that of Fairley and Penrose in Melbourne, 1928 (*Aust. Med. Journ.*, 24th November, 1928, Vol. II, No. 21). Their figures relating to age incidence may be summarized as follows :—

Sheep under three years, 7·7 per cent. ; over three years, 26 per cent.

Cattle under one year, 3·5 per cent. ; over three years, 36·2 per cent.

Pigs under one year, 0·4 per cent. ; over three years, 5·2 per cent.

Disregarding the age factor the observed incidence in cattle, sheep, and pigs is given by various authorities as follows :—

| —— | Cattle. | Sheep. | Pigs. |
|---|---|---|---|
| | Per Cent. | Per Cent. | Per Cent. |
| New South Wales .. .. | 37·1 | 35·7 | .. |
| Western Australia .. .. | 19·7 | 20·1 | 0·75 |
| Victoria .. .. .. | 23·9 | 16·5 | 0·5 |
| New Zealand .. .. | 43·0 | 46·0 | .. |

These New Zealand figures were collected in August, 1928, and are probably higher than they would be if taken throughout the year, since at that season very little young stock is killed. Other factors from which one might anticipate a somewhat higher incidence in cattle and sheep in this country are that the climatic conditions are more favourable to survival of the eggs outside the body than they are in Australia, and that New Zealand carries much more stock per acre than does Australia.

It will be noted that in the observations quoted cattle show the highest incidence, sheep coming a very close second, and that pigs are much less commonly affected. This last is probably due to the earlier age at which they are killed—usually five to ten months.

In spite of the higher incidence of cysts in cattle, however, their viscera is a far less potent source of infestation in the dog than is that of sheep, because the majority of the cysts found in cattle are sterile or degenerated, whereas in sheep and pigs they are usually active. This is well shown by figures quoted by Monnig in a recent work on Veterinary Parasitology. According to his observations, only 10 per cent. of bovine cysts compared with 80 per cent. of porcine ones and 92 per cent. of ovine cysts contain live brood capsules and scolices.

In domestic animals these cysts develop almost exclusively in the lungs or liver. Sometimes they may be found in the spleen, the kidney, or in connection with the pleura or peritonium, and much more rarely in some remote part of the body, for example, in bone, or in the heart or brain. But the lungs and liver, as already stated, are the organs affected in the vast majority of cases.

hen the eggs of the parasite are ingested by a suitable host embryos emerge from them into the intestine, migrate into the blood-stream, and are carried by it to the different organs. Having come to rest in a suitable spot the embryo develops into a large bladder known as an *Echinococcus* or hydatid. These bladders have an outer cuticle which is fairly thick, and laminated concentrically, and are lined inside with a much more delicate membrane—the germinal layer. If all goes normally it is said to be about six months after ingestion of the eggs by the intermediate host that the resulting cysts or hydatids commence to form brood capsules and scolices. Within this parent cyst daughter cysts are commonly found, having exactly similar structure to that of the parent, and within them again grand-daughter cysts may occur. One sometimes finds in the bovine liver a mass of small cysts separated from each other by fibrous tissue. This is often referred to as "*Echinococcus multilocularis*." There is some doubt as to its actual nature, since the cysts are invariably sterile, but it is very generally held to be a manifestation of *Echinococcus* infestation.

In cattle, sheep, and swine the presence of hydatid cysts very seldom causes detectable illness. It depends on the site affected and the number and size of the cysts.

It is very fortunate for the farmer, but is definitely inimical to effective control measures which depend on his co-operation, that the presence of hydatids in the liver and lungs cause so little financial loss. In practically all cases it is only these parts which need to be condemned, and their value is extremely small.

That only an intensive educational campaign will result in this disease being overcome is now widely recognized by all who are interested

in the problem. The Live-stock Division have been endeavouring to improve matters for years by the use of press publicity, by lectures to farmers, and latterly by means of broadcasting. All Meat Inspectors are particularly instructed to prohibit dogs from entering slaughtering-places.

The last feature of this problem on which comment is desirable is the treatment of dogs by arecoline hydrobromide. The efficacy of this for the removal of tapeworms was first stressed by Hall in America, and shortly afterwards by Ross in Australia, who showed how remarkably effective it was in removing *Echinococcus granulosus* from dogs. The dosage is given in the circular and poster that have recently been issued. The proper dosage expels *practically* all the tapeworms present: it is not 100 per cent effective in all cases.

The tapeworms expelled are of no further consequence, but the drug leaves their eggs intact and unharmed, and as each ripe segment contains 500 or so the need for destroying the motions properly is obvious.

While evacuation may commence in a few minutes after dosing, the worms are mainly expelled in the later motions, usually about half an hour after dosing. Dogs should be tied up for some hours therefore, till the effect of the treatment has ceased.

When dogs are experimentally infested with tapeworms by feeding hydatid cysts, it is about the forty-seventh day that eggs are first detected in the fæces—hence the reason for the suggested repetition of dosing at about that time.

Flies alighting on canine fæces containing *Echinococcus* eggs have been found capable of actually ingesting the eggs intact. Hence the possible danger from flies as well as from drying and blowing about as dust if the motions of a dog treated for tapeworm infestation are not adequately collected and destroyed.

# FARMERS' FIELD COMPETITIONS, WELLINGTON DISTRICT.

## SEASON 1934-35.

W. J. McCulloch, Fields Superintendent, and N. Lamont, Assistant Instructor in Agriculture.

Over a period of years farmers' field competitions have amply justified their importance both to the farmer and the Department as a means of obtaining a mass of valuable first-hand information about specific localities at a minimum of cost to both, and the past season is by no means an exception to the rule.

Looking back over the past history of the movement it has, like various other agricultural projects, had its waves of varying popularity. The early interest in the movement by a district community, often marked by a large volume of entrants, after a time appeared to wane to some extent, but generally this was followed later by a steady increase both in numbers of entries and in general interest.

Improved organization in the management of these competitions as a result of more and wider experience has provided a much better foundation on which to build, and it now seems safe to predict that

farmers' field competitions have arrived at a stage where progress will be steady and lasting. In such work, where the quality of the soil has an important bearing on results, very real difficulty is encountered by the various executives in evolving rules to govern the judging of crops, and while it is agreed that the aim of the movement is to encourage better farming methods, or, in other words, to judge the method of the farmer and not the quality of his land as is sometimes indicated by the heaviest yields, those in control are earnestly advised to continue to seek a solution to this problem. The main difficulty appears to arise from the fact that too many points are allotted for yield and not enough for management during the growing-period. Two organizations who recognize this problem deserve credit for striving to overcome the difficulty by allotting an award for the most meritorious crop.

During the season under review a total of 912 farmers in the Wellington, Taranaki, Hawke's Bay, and Poverty Bay Provincial Districts entered in the competitions. The following table shows the number of entries and the average yields in each competition compared with those of last year.

| Competition. | Number of Competitors. | | Average Yields, in Tons per Acre. | |
|---|---|---|---|---|
| | 1935. | 1934. | 1935. | 1934. |
| Mangels .. .. | 160 | 105 | 76·11 | 63·88 |
| Swedes .. .. | 97 | 123 | 35·78 | 54·36 |
| Carrots .. .. | 67 | 50 | 46·25 | 50·06 |
| Chou moellier .. .. | 14 | 12 | 23·27 | 30·14 |
| Soft turnips .. .. | 5 | 6 | 33·50 | 48·60 |
| Mixed roots .. .. | 7 | 6 | 37·65 | 42·50 |
| Ensilage .. .. | 274 | 330 | .. | .. |
| Hay .. .. | 170 | 197 | .. | .. |
| Pasture .. .. | 107 | 115 | .. | .. |
| Winter feed .. .. | 11 | .. | .. | .. |

It is difficult to draw exact conclusions from a comparison of the average yields of this year and last year, on account of the most unfavourable conditions that were experienced this year. The averages for all crops show a decrease, with the striking exception of mangels, which show an increase of approximately 19 per cent. over last year. The decrease in the case of swedes is approximately 34 per cent. on last year, and in the case of carrots about 7 per cent. The inference is, then, that under competition conditions, when all crops are reasonably well managed, the reliability of swedes in face of unfavourable conditions cannot compare with mangels or carrots.

## Mangels.

The number of mangel entries judged this year was 160, as compared with 105 last year. Results and methods of district prize-winners are given in the accompanying table.

Prizewinner Yellow Globe is still very prominent in the prize-lists. In general, the management of crops by those who won prizes was characterized by thorough cultivation, particularly in the early stages of growth, and the comparative success of mangels under the dry conditions obtaining last season is without doubt due in some measure to this factor, as well as to the inherent drought-resisting properties of this root.

Manurial practices varied a great deal both within and between districts. Mixtures including blood and bone and superphosphate were most popular among the prizewinners, applied in amounts of from 4 cwt. to 10 cwt. per acre, and a large number had been liberal with dressings of farmyard manure. It is interesting to note that a number of winning crops were grown on land that had carried a mangel crop the previous year. Mr. H. T. Paul grew the winning crop in North Taranaki this year on the area which last year produced the record crop. His success is attributed to the persisting effect of farmyard manure applied last year not only by virtue of the valuable plant-foods it contains, but also because of its beneficial effect on the moisture-holding capacity of the soil.

The widths between rows of mangels varied among the winning competitors — from 14 in. to 34 in. — and the opinion has been expressed that many growers are in effect wasting ground by keeping rows too far apart. No doubt the ideal is to have the mangels almost touching on all sides, but in practice the width between rows must depend on whether the crop is to be hand-cultivated or whether horses are to be used. The general rule, then, would be that the width between rows should be the minimum that will permit cultivation by hand or by horses, whichever is more economic under the circumstances. On small areas that are to be hand-cultivated the rows may be no more than 14 in. apart, but where horses are to be used probably 22 in. is the minimum.

It is probable also that yields are reduced through crops being thinned more than is desirable, and there is evidence which tends to indicate that heavier crops can be grown when thinning to about 7 in. to 8 in. is practised than when the thinning is to 9 in. to 10 in.

## Swedes.

The swede-growing competitions attracted 97 entrants, as compared with 123 the previous year. The accompanying table indicates district winners, and summarizes their methods and results.

The Superlative swede was very prominent in the prize-list, being used by ten out of the fourteen prizewinning growers. The most favoured fertilizer was a dressing of about 3 cwt. to the acre in which phosphate predominates. Considerable trouble has been experienced throughout the southern half of the North Island with cruciferous crops due to their susceptibility to the effects of drought to club-root and dry-rot, and to the attacks of such pests as turnip-fly, diamond-back moth, and the white butterfly. In consequence there is a certain amount of hesitation in attempting the production of swede crops and crucifers in general and a desire to replace them by more reliable crops. It is possible that the apparent greater susceptibility of swedes to drought is due, in part at least, to the less thorough cultivation which is the general lot of swede crops, as a surface layer of loose soil is considered to result in greater retention of moisture by the soil. Furthermore, a plant weakened by drought is less able to resist the attacks of pests and diseases. Despite the above comments, based on the reports of the competitions, it is felt that in favourable districts swedes could be grown with advantage more extensively than has been the case in recent years.

## Carrots.

The number of carrot crops judged this year shows an increase over last year — from 50 to 67 — the majority being grown in Taranaki. The accompanying table contains the principal results.

The success of the Guerande carrot is striking and interesting in that it illustrates that profitable yields can be obtained from this variety, which has the virtue of growing well out of the ground, and, on this account, is easy to harvest or feed off. It is admitted that, to be a success, carrot crops require painstaking cultivation, but it is in dry seasons like last year when the reward for good cultivation is reaped owing to the drought-resistance conferred.

It is reported that the dry weather caused some types of white varieties to bolt to seed, and this tendency is reflected in the lower yields of these varieties and in the lower average yield of all varieties.

Superphosphate and bone manures were most popular, in amounts varying from 3 cwt. to 8 cwt. per acre.

There is a definite place for carrots in cropping programmes where conditions are suitable. Yields obtained in the competitions compare more than favourably with yields of swedes, the average of the former exceeding that of the latter by approximately 10 tons per acre. In addition to being a more certain crop, carrots have a slightly greater feed-value than swedes. In view of the increased attention to crops grown for pigs it is to be noted the carrot is valuable in pig-feeding.

## Ensilage.

The number of entries judged in the ensilage competitions showed a decrease as compared with last year—from 330 to 274—one of the principal reasons for this being the fact that many farmers were compelled by unfavourable weather to feed out before their entries could be judged.

In North Taranaki these competitions were very popular and the number of competitors so great that they were divided into classes. The winning competitors in the various classes were—Stack silage (pasture), Mr. A. N. Mills; stack silage (A.O.V.), Mr. H. T. Paul; stack silage (hillside), Mr. F. D. Ballantyne; concrete-pit silage, Mr. E. C. Lacke; earth-pit silage, Mr. J. H. Paulger.

In South Taranaki the winners were—Stack silage, Mr. E. Burnand; pit silage, Mr. C. Jones.

In other districts, where classes were unnecessary, the first prize winners were — Wairarapa, Mr. A. Booth; Hawke's Bay, Mr. F. de Stacpoole; Gisborne, Mr. M. O'Sullivan, Ruatoria Maori Competition, Mr. J. Dewes; Wairoa, Mr. H. S. Findsen.

On the results of the competitions it is not possible to dogmatize with regard to the relative merits of stacks, pits, silos, or trenches, and excellent silage has been made by the different methods. The choice generally depends on the topography of the farm, and although it is probably more difficult to build a stack which results in good silage with little waste than it is to spread the material in a pit, the convenience of the former accounts for its popularity. Where a low, steep bank is available which is conveniently situated and on a well-drained spot, the hillside pit is excellent.

It is inevitable that there should be a certain amount of wastage in stack silage around the sides. A round stack is preferable in this regard to a square one, which will have more waste at the corners. It is necessary that the earth cover be put on immediately after building and brought well out to the edge.

In a number of cases there was considerable waste around the sides of the pits due to the material drawing away from the pit-walls when settling. The practice of winning competitors indicates that this is fairly easily overcome by having the top of the pit a little wider than the bottom.

One of the most common mistakes resulting in low-grade silage was the postponement of cutting until the material was too mature. The recognition of the exact time to cut requires experience and judgment, and very dry weather may cause the material to be less sappy than its appearance indicates. It is probable that silage rarely suffers through the material being too immature. It unfortunately happens that a great number of farmers who are fully aware of the necessity of cutting at the early correct stage are prevented from doing so by labour considerations. To some extent, an over-mature material may be prevented from excessive heating by rapid building and immediate covering. One farmer is reported to have used water with some success. A few use salt and molasses with the idea of increasing palatability. Such expedients, however, cannot take the place of cutting at the right stage and must be regarded merely as attempts to save material that might otherwise be inferior.

The competitions have very forcibly demonstrated the fact that, other things being equal, the quality of the silage depends on the quality of the raw material used. Where pasture was used the best silage came from good pastures. The principal function of ensilage probably always will be the conservation of the surplus from pastures. The competitions have clearly demonstrated that excellent silage can be made from lucerne, oats, maize, millet, &c.

## Hay.

Competitions for hay were conducted only in the Taranaki District, and attracted 170 entries. The first-prize winners in South Taranaki were—meadow hay, Mr. F. Olliver; lucerne hay, Mr. J. Prout; and in North Taranaki, Mr. R. Cassie.

## Pasture.

A pasture competition was conducted in the North Taranaki district, and 107 farmers participated. Further details of this competition appeared in an article in this *Journal*, September, 1935.

## Miscellaneous.

Competitions for chou moellier crops were conducted in South Taranaki and Hawke's Bay. In the former district the competition was won by Mr. F. Jenkins, Eltham, with a yield of 29 tons 1 cwt., and in the latter district first place was gained by Mr. A. W. Montgomerie, Norsewood, with 28 tons 2 cwt.

*Table giving District Prizewinners and Summary of their Methods and Results*

| District. | Grower. | Variety. | Yield. | Seed per Acre. | Manure (kinds). | Amount. | Sowing-date. | Width of Drill. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| **MANGELS.** | | | | | | | | | |
| North Taranaki .. | H. T. Paul(1) .. | Prizewinner Yellow Globe | 149·5 | 5 lb. | Green bone .. | 4 cwt. | 23rd October .. | 22 in. | Lime previously applied at 15 cwt. per acre. |
| | | | | | Potash .. .. | 2 cwt. | | | |
| | | | | | Superphosphate .. | 2 cwt. | | | |
| South Taranaki .. | A. T. Burke(1) .. | Prizewinner Yellow Globe | 153·75 | 6 lb. | Proprietary .. | 6 cwt. | 2nd November | 14 in. | Well supplied with farmyard manure. |
| Manawatu .. | H. Hancock(1) .. | Red Intermediate .. | 143·06 | 5 lb. | Blood and bone .. | 5 cwt. | 20th October .. | 22 in. | 4 cwt. salt previously applied. |
| Wairarapa .. | J. H. Bremner(1) .. | Prizewinner Yellow Globe | 87·1 | 7 lb. | Superphosphate .. | 4 cwt. | 5th October .. | 27 in. | Early January 2½ cwt. am. super. per acre. |
| | | | | | Blood and bone .. | 1 cwt. | | | |
| | | | | | Sulphate of ammonia .. | | | | |
| Hawke's Bay .. | G. Kells(1) .. | Prizewinner Yellow Globe | 96·35 | 6 lb. | Special mangel .. | 10 cwt. | 16th November | 20 in. | .. |
| Gisborne .. | S. D. Briant(1) .. | Red Chief Intermediate | 107·8 | 5 lb. | Proprietary .. | .. | Mid-October .. | 28 in. | No manure. |
| Wanganui .. | B. Birch(1) .. | Prizewinner Yellow Globe | 146·85 | 9 lb. | Equal parts bonedust and superphosphate | 10 cwt. | 20th October .. | 25 in. | .. |
| Woodville .. | W. D. Beagley(1) .. | Prizewinner Yellow Globe | 93·85 | 6 lb. | Proprietary .. | 6 cwt. | .. | 24 in. | 3 cwt. kainit previously applied. |
| Halcombe .. | E. W. Barnett(1) .. | Prizewinner Yellow Globe | 93·6 | 7 lb. | Superphosphate .. | 2 cwt. | 2nd October .. | 28 in. | .. |
| **SWEDES.** | | | | | | | | | |
| North Taranaki .. | D. Johnston(1) .. | Superlative .. | 61·85 | 9 oz. | Superphosphate and slag | 5 cwt. | .. | 7 in. | .. |
| South Taranaki .. | D. Malone(1) .. | Grandmaster .. | 51·9 | 10 oz. | Basic slag .. .. | 2½ cwt. | November | 7 in. | Farmyard manure previously applied. |
| Manawatu .. | Jacob and Son .. | Superlative .. | 28·5 | 1½ lb. | Phosphate and superphosphate | 3 cwt. | 5th November | .. | Only entry. |
| Wairarapa .. | W. Kjestrup(1) .. | Superlative .. | 51·85 | 11 oz. | Proprietary .. | 2½ cwt. | 15th December | 14 in. | .. |
| Hawke's Bay .. | A. W. Montgomery .. | Superlative .. | 35·7 | 12 oz. | Lime and superphosphate .. | 1½ cwt. 3 cwt. | 8th January | 7 in. | .. |
| **CARROTS.** | | | | | | | | | |
| North Taranaki .. | W. J. Bridgeman .. | Holmes Improved .. | 63·8 | 2 lb. | Green bone .. | 2½ cwt. | 8th November | 14 in. | Half potash predrilled. |
| | | | | | Superphosphate .. | 1½ cwt. | | | |
| | | | | | Sulphate of potash .. | 1½ cwt. | | | |
| Hawke's Bay .. | G. Kells(1) .. .. | Guerande .. | 55·6 | 2 lb. | Superphosphate .. | 3 cwt. | 26th November | 14 in. | .. |
| Wanganui .. | N. Hughes(1) .. | Guerande .. .. | 86·6 | 2½ lb. | Superphosphate .. | 3½ cwt. | 14th November | 21 in. | .. |
| | | | | | Carbonate of lime .. | 10 cwt. | | | |
| South Taranaki .. | A. T. Burke .. | Matchless White .. | 66·4 | 2 lb. | Proprietary .. | 6 cwt. | 2nd November | 14 in. | .. |

A soft-turnip competition was conducted in South Taranaki, and was won by Mr. A. D. Johnson, Lowgarth, with a yield of 40 tons 10 cwt., while Mr. R. Jones, in the same locality, was a close second with 39 tons 4 cwt.

Mr. L. Bishop, Tarurutangi, gained first place in a mixed-crop competition in North Taranaki with a crop of Prizewinner mangels and Superlative swedes.

A very interesting competition was conducted for Maori farmers in Ruatoria and the East Coast with regard to winter feed provision, points being allotted for condition of cows, condition of pastures, and special winter feed provided. The cup was won by Mr. Niha Pei, with Mr. B. Walker and Mr. D. Hughes second equal, and Mr. P. Dewes third.

It has also been the custom in North Taranaki to award a points prize in addition to the separate prizes for each competition. This prize has been won again by Mr. H. T. Paul, Okato, whose entries gained championships in mangels, and A.O.V. silage. Mr. J. H. Paulger, Tikorangi, was second, and Mr. W. F. Goodwin, Okato, third.

### Conclusion.

Mention must be made of the willing and efficient manner in which the farmers' executives have conducted these competitions and of the various officers of the Department of Agriculture who have acted as judges. This summary of results has been compiled from the reports of officers in various districts.

There is no doubt that those who have made these competitions possible have performed a very valuable service for the farming community, especially when the increasing importance of supplementary feed is appreciated. The increasing use of fertilizers for top-dressing pastures has resulted in a general increase in carrying-capacities and consequent difficulty of providing for stock in the winter period. Efficient manurial practices in pasture-management have resulted in an extension at each end of the growing-period, but this by no means offsets the greater demand due to heavy summer stocking on top-dressed pastures. Even if we assume that top-dressing has resulted in an increase in winter growth in the same proportion as the increase in summer growth, the actual amount of the seasonal difference is increased.

In consequence, the provision of supplementary feed has become progressively more necessary, and by field competitions farmers are enabled to discover the practices most appropriate to their circumstances.

## INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 3rd October, 1935, to 28th November, 1935, include the following of agricultural interest:—

No. 73447: Coulter-clamp; W. I. Ashby. No. 73481: Carcass-hoist; T. D. Barker. No. 74435: Fertilizer-distributor; P. and D. Duncan, Ltd. No. 74545: Seed-sower; P. and D. Duncan, Ltd. No. 72423: Tractor-grip; D. Bell. No. 72659: Fibre-dressing; A. Morrison. No. 72921: Testing and grading eggs; P. B. Stevens. No. 73086: Fibre-dressing; *cognate with* No. 72659 above. No. 73436: Refrigerating-machine; W. B. Normelli. No. 73508 and No. 73564: *cognate with* No. 72659 above.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

# OBSERVATIONS ON THE GERMINATION OF NEWLY HARVESTED ALGERIAN OATS.

E. O. C. HYDE, Assistant Seed Analyst.

IT is characteristic of the seeds of many plants that they do not germinate readily when newly ripened. During the storage of such seed a process of "after-ripening" goes on whereby the seeds are rendered capable of prompt germination. The oat grain is a seed of this kind. The delayed germination, often observed when oats are sown before the completion of after-ripening, is a matter of concern to the farmer and seed-merchant, and also to the seed analyst.

Most farmers are aware that the sowing of newly harvested oats is attended by the risk of failure on account of irregular germination. For this reason oats which have been held over from a previous season are generally preferred for late summer and early autumn sowings. When newly harvested seed is used it is a common practice to increase the rate of sowing to help to ensure a satisfactory "strike."

Those engaged in the testing of agricultural seeds for germination were early confronted with the problem of obtaining rapid and complete germination of oats during the early weeks after harvesting. Several expedients were resorted to—for example, cutting the grains to expose the endosperm, or removing the glumes: Dorph-Petersen(3), Anderson(1). These methods did not gain general approval, and have been abandoned in favour of the practice of conducting germination-tests of newly harvested oats at low temperatures. Atterberg(2) appears to have been the first to observe that oats when not completely after-ripened will germinate promptly at low temperatures. It has since been reported by Eastham(4), Frank(5), and Whitcomb(7) that in testing the germination of newly harvested oats the most satisfactory results are obtained by the use of a temperature of from 5° to 10° C. during the first five days of the testing period, and for the remainder of the time a temperature of from 18° to 20° C.

The practice of testing newly harvested oats at low temperatures has been adopted at the Official Seed-testing Station, and has proved very satisfactory as a means of determining rapidly the proportions of living and dead seeds, and thus indicating what the value of the grain for seeding purposes will be when after-ripening is complete. Such tests, however, do not give any information as to the stage reached in the after-ripening of the seed, and are therefore of limited use when early sowing is contemplated. When it is necessary to use newly harvested seed for early autumn sowing it would be of more value to know what proportion of the seed is capable of germinating promptly in the field at that time. Such knowledge would be of assistance in selecting seed and deciding upon the rate of sowing.

The present work was undertaken to determine whether the technique of germination testing could be adapted to provide a means of gauging the suitability of newly harvested oats for autumn sowing.

Preliminary studies gave support to the presumption that soil temperature is the predominating external factor influencing the germination of oats in the field during the after-ripening period. A

more elaborate study was therefore made of the influence of temperature conditions upon the germination of oats before and after the completion of after-ripening. Field germination tests were made and the results studied in relation to soil temperature and compared with results of laboratory tests.

## Material and Methods.

Twenty-five samples of Algerian oats, mostly from crops grown in the Manawatu district, but including also others from Hawke's Bay and Canterbury, were used in the course of this work. The estimates of percentage germination were in all cases based on tests of four hundred seeds. Except where otherwise stated the duration of the laboratory tests was twelve days and of the soil-tests fourteen days. In many of the laboratory germination tests the temperature was alternated daily between two levels, the lower temperature being maintained for about sixteen hours and the higher for about eight hours. In most of these tests the night temperature was 20° C. and the day temperature 30° C. For brevity this temperature provision will be referred to as "20°–30° C." Field germination tests were made in the open ground in well-cultivated clay loam. Each lot of 100 seeds was sown from 1½ in. to 2 in. deep in a drill 4 ft. long.

## Germination of Fully After-ripened Grain.

A composite sample representing several lots of completely after-ripened Algerian oats was tested at various constant and alternating temperatures. In Table I the progress of germination at various constant temperatures is shown. Complete germination resulted at all temperatures used from 5° to 30° C. The greatest speed of germination was shown at 20° C. Of the numerous combinations of temperatures tried in daily alternation as described above the following gave a speed of germination almost equal to that shown at a constant temperature of 20° C.; 20°–40° C., 20°–35° C., 20°–30° C., 20°–25° C., 15°–30° C., 15°–25° C.

*Table I.—Progress of Germination of Completely After-ripened Oats at Various Temperatures.*

| Temperature. | Percentage Germination in Specified Number of Days. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| Degree C. | | | | | | | | | | |
| 5 .. .. | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 26 | 65 | 94 |
| 10 .. .. | 0 | 0 | 0 | 11 | 77 | 92 | 98 | .. | .. | .. |
| 15 .. .. | 0 | 43 | 88 | 99 | .. | .. | .. | .. | .. | .. |
| 20 .. .. | 9 | 93 | 99 | .. | .. | .. | .. | .. | .. | .. |
| 25 .. .. | 0 | 46 | 86 | 98 | .. | .. | .. | .. | .. | .. |
| 30 .. .. | 0 | 10 | 19 | 34 | 54 | 63 | 72 | 85 | 98 | .. |

Compared with the seeds of most other cultivated plants the oat grain is, when fully after-ripened, capable of germination within a very wide range of temperatures.

## Germination of Incompletely After-ripened Grain.

The germination of seventeen samples of incompletely after-ripened oats was studied in a similar manner. Table II illustrates for one of these samples the progress of germination at various temperatures. It was observed that in comparison with the fully after-ripened oats the behaviour of the incompletely after-ripened samples differed in three ways. Firstly, the optimum temperature for rapid germination was lower, being in the vicinity of 14° C. Secondly, the speed of germination at low temperatures was higher than that of fully after-ripened oats under the same conditions. Thirdly, at temperatures of 18° or 20° C. and higher, the germination of a proportion of the grains was greatly delayed. These three features were observed in the behaviour of all the samples of newly harvested oats handled during this work.

*Table II.—Progress of Germination at Various Temperatures of Oats not fully after-ripened.*

| Temperature. | Percentage Germination in Specified Number of Days. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Degree C. | | | | | | | | | | | |
| 5 .. .. | 0 | 5 | 64 | 99 | .. | .. | .. | .. | .. | .. | .. |
| 12 .. .. | 32 | 98 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 20 .. .. | 12 | 33 | 40 | 48 | 60 | 72 | 85 | 94 | 99 | .. | .. |
| 20–30 .. | 0 | 7 | 12 | 18 | 27 | 38 | 47 | 62 | 74 | 90 | 96 |

When samples of dormant seed were left in the incubator at a temperature of from 18° to 20° C. germination occurred sporadically over a long period, extending in several cases still under observation to over eighteen months. A marked change in the consistency of the endosperm is to be observed in grains of which the germination is much delayed. The endosperm becomes reduced to a fluid "milky" condition. Harrington(6) states that the seedlings from such grains are weakly or otherwise abnormal. Observations made during the present work failed to confirm this.

Frank(5), Eastham(4), Whitcomb(7), and others have shown that newly harvested oats will germinate at higher temperatures after pre-chilling under moist conditions. In the present studies it was found that sixty hours on moist filter paper at a temperature of from 5° to 10° C. rendered most samples of incompletely after-ripened oats capable of complete and rapid germination at 20° C. or at 20°–30° C. The small upper grains were sometimes slower to respond to this pre-chilling treatment.

As already stated, the germination of new oats is greatly delayed at temperatures of 20° C. or higher, but takes place readily at about 10° C. However, it was observed that if new oats which had been placed in a germinator at the higher temperature for six days or more were transferred to a germinator at 10° C. there was little immediate response, and complete germination was delayed in many cases for three months or longer. It thus appears that the

effect of the higher temperatures is not only to inhibit germination during the period of exposure, but also to induce a more intense state of dormancy. This intensification of dormancy by warm, moist conditions was observed consistently in the early stages of after-ripening, but became rapidly less apparent as after-ripening progressed.

It has been reported(8) that secondary dormancy may be induced in new oats by prolonged exposure to low temperatures. This was not confirmed in the present work. Newly harvested oats germinated completely within twenty days at from 2° to 5° C., although the growth of the embryo was very slow.

### Comparison between Field and Laboratory Germination.

In January, 1935, eight samples of Algerian oats were obtained shortly after harvesting, and these were tested for germination in the field in the manner already described, and in the laboratory at 12° C. and at 20°–30° C. These tests were repeated at intervals of fourteen days. A fully after-ripened sample was included in each sowing. All tests of this sample showed a rate of germination in excess of 96 per cent. For the incompletely after-ripened samples the maximum rate of emergence of seedlings occurred about the eighth day after sowing. Thereafter the rate of emergence dropped sharply, but additional seedlings continued to appear intermittently over a period of several months, until the observations were discontinued.

The laboratory tests at 12° C. gave complete germination in all cases. In the laboratory at 20°–30° C., and also in the field, the percentage rates of germination were in the earlier tests very low, but became progressively higher as the tests were repeated at fortnightly intervals during the period of after-ripening. In Fig. 1 the results of tests on one of these newly harvested samples are presented. It is seen that the percentage germination in the field was in each case in close agreement with the result of the test made at the same time in the laboratory at 20°–30° C.

Twenty-five comparative tests of germination in the field and in the laboratory at 20°–30° C. were made. The results of these tests are assembled in the correlation diagram (Fig. 2). A high measure of positive correlation is indicated. The incompletely after-ripened grain showed a slightly higher germinating-capacity in the field than in the laboratory at 20°–30° C. When after-ripening was complete the percentage germination in the laboratory generally exceeded slightly that in the field.

In Table III is presented a record of the soil temperature at a depth of 2 in. on the plot. Readings were taken daily at 6 a.m. and 1.30 p.m. It is probable that these readings approximate closely the daily minimum and maximum soil temperatures respectively. The mean soil temperature recordings for each fourteen-day testing-period are lower than the temperature conditions (20°–30° C.) used in the laboratory for the comparative tests. It appears reasonable to attribute to this the fact that the rate of germination of new oats in the field was in almost all cases a little higher than the rate of germination in the laboratory, at 20°–30° C. It may be noted here that there is reason to expect that in drier and darker soils the temperatures during the late summer would be somewhat higher than those recorded during the present work.

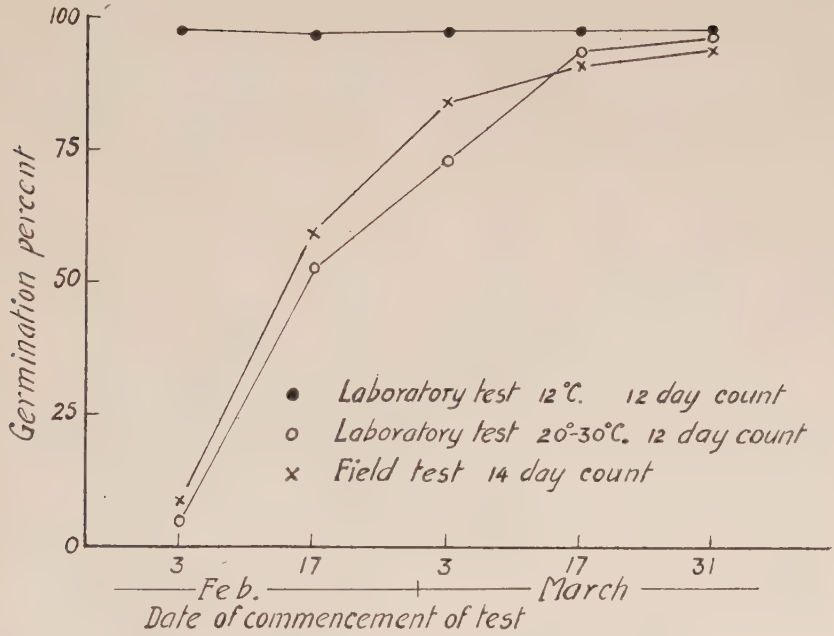


FIG. 1. GERMINATION OF NEWLY HARVESTED OATS UNDER VARIOUS CONDITIONS. Tests repeated at fortnightly intervals throughout the period of after-ripening.

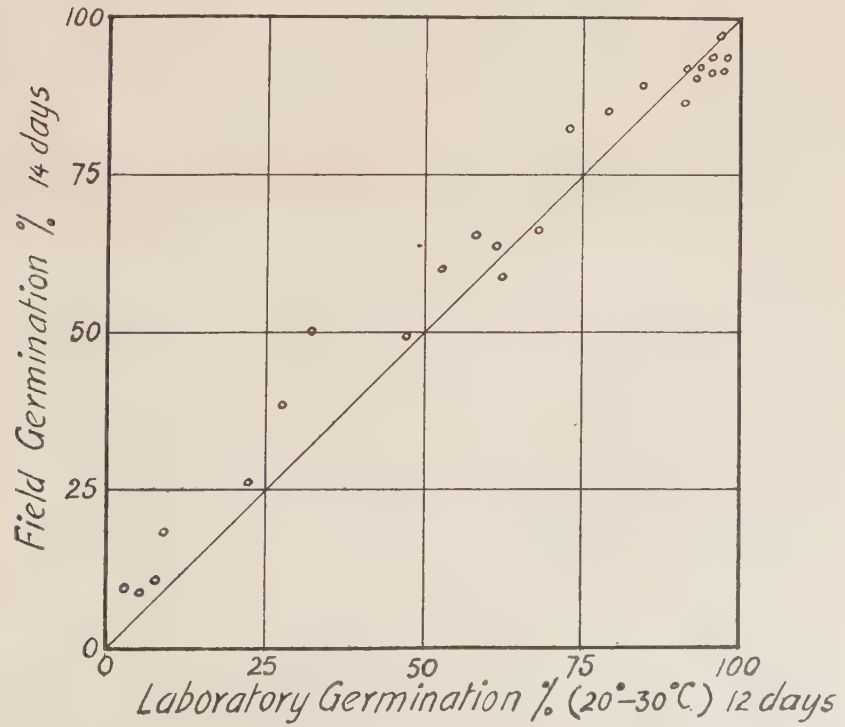


FIG. 2. CORRELATION BETWEEN FIELD GERMINATION AND LABORATORY GERMINATION AT 20°–30° C.

*Table III.—Soil Temperature at a Depth of 2 in. on the Field Plot.*

| Period occupied by Germination Test. | Mean Daily Recording at 6 a.m. | Mean Daily Recording at 1.30 p.m. |
|---|---|---|
| | °C. | °C. |
| February 3 to February 17 .. | 19 | 30 |
| February 17 to March 3 .. | 17 | 27 |
| March 3 to March 17 .. | 16 | 27 |
| March 17 to March 31 .. | 15 | 26 |
| March 31 to April 14 .. | 14 | 25 |

As regards germination, the behaviour of the grain in the field was similar to that in the laboratory at temperatures comparable to the recorded soil temperatures. The delayed germination of incompletely after-ripened oats in the field may be fairly attributed to the high soil temperatures prevailing during the early months of the year.

It will be observed that in the case of the sample represented in Fig. 1 after-ripening was complete by the end of March. For other samples stored in the laboratory the dates on which this stage was reached ranged from late February to the end of April. From the limited data so far obtained it appears that the rate of after-ripening in the seed-store is slower than that under sample storage conditions in the laboratory.

## Conclusion.

The object of this work was to find a means of determining the suitability of lots of newly harvested oats for early sowing. It is considered that the laboratory test with the temperature alternating daily between 20° and 30° C. might be tentatively adopted for this purpose. It is suggested that where newly harvested oats are intended for early sowing such a test should supplement the standard test at a lower temperature. The latter test would indicate the percentage germination which might be expected when the seed is completely after-ripened or is sown when soil temperatures are low. The former test would give an estimate of the percentage of grains which at that time are capable of germinating promptly under summer field conditions. If by this test a low-percentage germination is shown, the sowing may be delayed, or the rate of sowing increased, or other seed utilized.

It should be understood that the progress of after-ripening during the period from the commencement of the test to the time of sowing will render an increased proportion of the grains capable of germinating promptly in the field. To be of greatest use it would therefore be necessary to make the test as shortly as possible before the time of sowing.

## Acknowledgments.

The writer wishes to record his appreciation of the assistance given by Mr. O. Galpin, of the Department of Agriculture, Palmerston North.

For the samples of grain used in this work the writer is indebted to the following seed-houses: Messrs. Hodder and Tolley, Ltd., Palmerston North; the Hawke's Bay Farmers' Co-operative Association, Ltd., Waipukurau; New Zealand Loan and Mercantile Agency Co., Ltd., Oamaru; and the National Mortgage and Agency Co. of New Zealand, Ltd., Waimate.

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# DRY-DUSTING OF CEREALS.

## AN EFFICIENT HOME-CONSTRUCTED PLANT.

T. A. SELLWOOD, Instructor in Agriculture, Oamaru.

THE treatment of the seed prior to sowing the cereal crop for the purpose of preventing smut-diseases has long been carried out, but it is only during comparatively recent years that dry-dusting has taken the place of the wet "pickle." The wet pickles, usually solutions of bluestone or formalin, were quite effective in the prevention of disease, but there were many disadvantages associated with their use. Mr. J. C. Neill, in the *Journal of Agriculture*, July, 1934, fully deals with the disadvantages of the wet "pickle" and with the advantages of the dry-dusting method. He states that one of certain disadvantages of the dry-dusting method is the need for a special machine to do the dusting. This need not, however, be a very costly machine, and some farmers in North Otago have already constructed small plants to carry out this work. One of the most effective is that made by Mr. T. Perry, of Totaratahi, and this plant is proving most satisfactory. It consists of a 40 gallon drum mounted between two uprights at an angle and in such a manner that it can be revolved easily. Towards one end a trap-door is cut in the drum: this end must be the lower end when the drum is mounted. A lid of a heavier material than the drum, and allowing a fair overlap, is made, and this lid has four slots cut in it. These four slots correspond with four bolts welded on to the drum. The bolts are threaded and fitted with large thrumb screws. To ensure that the lid fits tightly to the drum during dusting operations a piece of thick felt slightly bigger than the lid is inserted between the lid and the drum prior to screwing

the lid down. The lining of an old horse-rug makes quite a good pad for this purpose. A shoulder is fitted to each end of the drum in such a position that when the drum is fixed between the uprights it is held at a fairly sharp angle, the axle passing through from the lowest point at one end to the highest point at the opposite end. A suitable axle and handle combined can be obtained by using an old windlass handle. Between the drum and the post on the handle-end a spacer washer is

MR. PERRY'S APPLIANCE FOR DRY-DUSTING SEED.

fitted in order that the rotary motion of the machine will not be interfered with. The spacer washer may be made from 1 in. water-pipe coupling. The uprights must be firm and strong. The cost of the plant in question was—Drum, 5s.; fittings—lid, handle, &c., £1 10s.; labour for erection, 10s.; total, £2 5s. The capacity of the drum is two bushels, and seventy to seventy-five revolutions makes a very satisfactory job of the dusting.

The location of the site for the plant is of importance. Ease of access for the handling of large quantities of seed is desirable, while the plant should not be in an enclosed shed as there is a danger of poisoning from the dust if the plant is operated in a confined space. The position of the machine on Mr. Perry's farm is an ideal one—*i.e.*, in the implement-shed where there is plenty of accommodation for seed and where the ventilation is particularly good.

# SEASONAL NOTES.

## THE FARM.

### Utilization of Special Summer Feed.

OFTEN the best results possible from special feed grown to supplement grassland is not secured because the use of such feed is not commenced early enough. In dairying this arises from the fact that many farmers do not realize how early the need for such feed normally becomes felt. Such special feed should be used not in remedying the position as much as possible after an avoidable drop in dairy production has taken place, but in obviating the occurrence of such a drop. Frequently this means that, if special feed is available, a commencement with the consumption of it should be made shortly after Christmas, for this is when an avoidable drop in production frequently begins, although many seem to deem it unnecessary to do any special feeding until about the beginning of February.

An unnecessarily rapid decline in butterfat-production at midsummer is of particular importance because it generally is correlated with a correspondingly lowered production during the remaining months of the producing-season. Many farmers believe they feed their cows well at the season mentioned, although they do not do so; often they tend to be misled by the ample amount of herbage on the paddocks into believing that the needs of the stock are fully supplied. Really, the stemmy pastures that are of common occurrence and that suggest plenty of feed are faulty for butterfat-production in respect to both their digestibility and their balance of nutritive substances. The only way to supply a fully suitable ration for butterfat-production is to feed leafy non-stemmy herbage which, if not available on the pastures, may be provided by the use of such material as young green lucerne, early quickly-maturing soft turnips, or the fresh aftermath of pastures mowed early for, say, ensilage. The crux of the midsummer dairy feed position is that lack of quality is probably a more frequent cause of unduly rapid decline of yield than is lack of quantity.

Because of the prevalence of stemmy growth in summer, young growing cattle are sometimes forced to subsist largely on it. This is serious mismanagement, because young growing stock, such as calves, develop well only when they receive highly digestible material, relatively rich in the substances required for the formation of bone and of muscle—stemmy growth is deficient in these materials, and its free use may lead to permanent stunting of developing stock.

As far as possible, young lucerne sown in November or December should be left unchecked by mowing as long as practicable, in order to favour the development of an extensive vigorous root-system, which is of value to the crop in subsequent competition with invading plants. However, if such young lucerne has been seriously out-grown by weeds, it probably will be sound practice to mow it towards the end of January.

In carting out soft turnips generally, it is advisable to scatter them well over the field in order that no part of it becomes unduly fouled with droppings, but, if the fertility of a particular area requires building up, feeding of the roots should be concentrated on that area.

Often the earlier-sown rape crops are ready for feeding-off in January. Lambs on rape should have a run-off on pasture, and, when the feeding of rape is being commenced, they should be allowed on it only for a short time.

In order to get the best results from millet, the feeding-off should be commenced when it is from 6 in. to 8 in. high: when it is fed at this stage it subsequently gives a valuable second growth.

### Forage Crop Considerations.

Frequently in January it is possible to estimate satisfactorily whether the prospective supply of feed for winter and early spring is adequate, and if it is not there is still time to make additional provision. If favourable weather is experienced in time to allow of the necessary preparatory cultivation, a useful measure in the case of ground which, if not already broken out of grass, would soon be so, is the sowing of temporary pasture in the late summer or early autumn. A temporary mixture generally useful consists of from 25 lb. to 30 lb. Italian rye-grass and 6 lb. of red clover an acre. Temporary pastures must be sown early to ensure that they provide a substantial amount of winter feed, and they generally can be depended upon for a heavy crop of hay in the next season.

When the land available for late summer or autumn sowing will be required in spring for another crop, it may prove well worth while to grow a catch-crop such as oats or barley, both of which usually are sown at the rate of about 2½ bushels an acre. Such cereal catch-crops, under favourable circumstances, yield considerable winter and early-spring feed, and may be followed by root or other suitable crops sown in the following spring. Catch-crops, after turnips or after another cereal crop, at times may be sown satisfactorily with a very small amount of preparatory cultivation: disking may give sufficient tilth for the seed-bed desired.

Frequently the full possible returns from cereal catch-crops or temporary pastures sown in the fall for winter feed are not obtained because the crops are sown too late. This is particularly true of the South Island. With such crops, a dressing of from 1 cwt. to 3 cwt. an acre of superphosphate usually is quite profitable: generally it increases both the rate and the amount of growth.

If sowing of turnips and swedes has not been completed by the end of December, it should as a rule be attended to as quickly as possible. When the rainfall is good sowing may continue to the end of January, but in most localities after mid-January it is safer to grow turnips than swedes, because turnips not only develop more quickly, but also suffer less from the ravages of insect pests which at times become serious after midsummer, especially in dry districts. Imperial Green Globe is a suitable turnip for January sowing. Both turnips and swedes usually respond well to a dressing of from 2 cwt. to 3 cwt. an acre of fertilizer in which superphosphate is prominent, and in which bonedust at times well may be included, especially if the land recently has grown other arable crops. Although generally sowing of lucerne in November or December is preferable, it may at times be sown successfully in January: this applies particularly to districts in which winter growth of plants in general is very small. On the other hand, in mild districts fall sowing of lucerne has often given unsatisfactory results: in such districts the winter cold suffices to make lucerne dormant, but many other plants, including rye-grass and common weeds, make enough growth through the winter to outgrow the young lucerne sufficiently to be able to deprive it of the direct sunlight which is necessary in the spring for its welfare.

### General Cropping Work.

Summer tillage of crops which permit of it is of paramount importance. In addition to having the obvious effect of destroying weeds, surface tillage is of marked value as a means of checking loss of soil-moisture. The full significance of this lies in the fact that in many districts, and especially in the drier ones, the most common cause of limited crop-yields is an inadequate supply of soil-moisture. Further, cultivation brings about soil-aeration which leads to improved fertility. Attention to summer cultivation usually

proves particularly profitable to the farmer who grows such crops as potatoes, mangels, swedes, and carrots in rows wide enough apart to allow of inter-tillage.

Potatoes, apart from needing inter-tillage and weeding at this season, usually should be moulded up. In districts in which the crop is likely to be subject to the attacks of the potato-moth moulding-up should be carried out with especial thoroughness, as well-covered tubers are likely to escape infestation by the moths.

It is very desirable to cut cereals at a suitable stage of ripeness. Investigation has shown that the best stage at which to cut wheat is when the green colour has been replaced by yellow in the section of the stem between the top " knot " and the head of about 99 per cent. of the stalks or straws. At this stage all " knots " are still green, and no dough can be squeezed from the grain, which, however, is still soft enough to be cut by the thumb-nail. Generally oats should be cut just when they attain a uniform yellowish appearance and before the final touch of green has disappeared. Quite often oats for chaff are cut when too ripe ; for chaff they well can be cut slightly earlier than the stage just described. Barley for malting should not be cut until it is dead ripe, as, if cut earlier, the germination of the grain is likely to be uneven, and this lowers its value for malting purposes.

As a rule thinning of such crops as mangels and carrots calls for attention at this season : undue delay in respect to this task may result in permanent stunting of the plants. If the seedlings are pale and seem not to be thriving sufficiently, a dressing of 1 cwt. an acre of nitrate of soda scattered along the rows close to the plants and hoed in after thinning may prove well worth while.

### The Pastures.

The task of pasture-establishment is a critically important one : the harmful effect of any weakness which arises in a permanent pasture at its establishment is likely either to be perpetuated throughout its life or to be removed only after considerable cost in respect to repair or replacement. Now that great permanence of good pastures usually can be assured by the use of suitable strains of seeds in conjunction with judicious top-dressing, it is particularly advisable to prevent any avoidable weakness developing in the sward at the outset.

Frequently the principal cause of poor-pasture establishment is the sowing of seed on poorly tilled ground—ground loose and lumpy, rather than fine and firm ; at other times the principal cause is late sowing of the seed. Usually both of these causes may be traced to the starting of preparatory cultivation at too late a date. This cultivation of land which is to be sown in permanent pasture in the autumn should now be kept in view. Intensive tillage for a short period may be employed to produce a fairly well pulverized seed-bed, but it is advisable to note that such tillage obviates the natural weathering which experience has shown to be of great value in producing economically the firmness and fineness of seed-bed that favour fully successful pasture-establishment.

If a seed-bed is not fine, the covering of the seed at greatly varying depths takes place, and hence if some of the seeds are sown at a suitable depth many others must be sown at unsuitable depths ; in pasture seeds which are relatively minute the risk is that a substantial proportion will be buried so deeply as to make it impossible for seedlings to be established from them.

Because lateness of sowing seldom tends to a complete failure, there seems to be an unfortunate tendency to overlook the harm that results from it ; while this harm does not get the attention that a complete failure would, it at times certainly is great enough to warrant steps to avoid it : it often consists of a thinning-out of the clovers and at other times of such slow weak development of most species in the mixture that weeds are given a greater chance of becoming prominent.

Sometimes there are serious weaknesses in the mixtures used for permanent pastures—weaknesses which cannot always be avoided when seed is purchased

in a hurried haphazard way which does not allow time for obtaining as much information as is desirable about the strain-characteristics and the germination capacity of the lines of seed offering. It clearly is unwise to leave the purchase of pasture seed mixtures to the last day or so before sowing. It is particularly desirable to be careful about seed which is offered at an attractively low price—such seed may constitute a bargain, but as a rule it is markedly dear because of its poor type or poor germination capacity. No farmer is likely to attain full efficiency and ignore in his purchase of seeds the present knowledge of different strain-characters within the one species. Full information regarding strains of pasture species and about pasture seed mixtures generally may be obtained from local officers of the Fields Division.

Pastures from which hay or silage has been saved may be expected to react profitably to a dressing of superphosphate applied as soon as the mown material has been removed. Such top-dressing tends to produce a greater immediate aftermath of fresh leafy feed which is especially valuable because it becomes available when such feed frequently is needed urgently—between the midsummer going-off of the pastures and the becoming available of such crops as soft turnips. Pastures mown at a somewhat immature, that is non-stemmy, stage generally have more vigorous and abundant aftermaths than similar ones mown at a later stage. Hence the former give the greatest immediate return from such top-dressing, but pastures mown at an over-mature stage frequently are weakened and so are in particular need of the benefit provided by judicious top-dressing.

Generally it is desirable to avoid seed-production or the development of stemmy rank growth of young, permanent pasture during its first summer. Such development may lead to the weakening of certain species, which, though relatively slow in growth in their early stages, are especially valuable in permanent pastures. When young pastures cannot be controlled suitably by the stock available, topping with a mower usually should be practised. Some pastures are used for seed-production during their first year, but these are special cases involving special returns from the seed-crop, and so are not a reliable guide as to economic general practice.

*—R. P. Connell, Fields Division, Palmerston North.*

## THE ORCHARD.

### Pest and Disease Control.

By the end of this month the last sprays prior to harvesting should have been applied to all early and semi-early varieties of peaches, and to the earlier varieties of apples. During the coming month of January, to the earlier of the export varieties such as Cox's Orange and Dunn's Favourite, a further application as outlined in the November notes, the last before harvesting, should be applied.

Where red mite is in evidence, a further effort should be made to eradicate it before the laying of the over-wintering eggs takes place.

The spraying recommendations given previously should be followed during the coming month, spraying being continued on each variety up to within three weeks of picking.

### Cultivation and Cover Crops.

Where a cover crop such as blue lupin is to be grown for ploughing under in the autumn, the soil should be put in excellent tilth, and the seed sown during the early part of January.

The soil should not be allowed to harden and crack. To prevent this where cover crops are not being sown, the cultivation should continue during January. Should dry weather set in, it is very necessary that the soil should be regularly stirred to maintain a good tilth.

### Thinning.

It is reported that very heavy crops of apples have set generally, and that a large crop is assured for the Dominion. This being so, there is every possibility of a larger quantity of apples than usual being available for disposal on the local markets. With the larger local surplus to dispose of, every effort should be made to prevent flooding the markets with second-grade fruit, and as far as possible this fruit should be eliminated by thinning. Where the trees are heavily laden, an endeavour should be made to remove all but fruit likely to develop into first-grade fruit. This not only assists the tree and the growing crop, but obviates the markets becoming over-supplied with low-grade fruit. Growers are strongly advised not to neglect the thinning of their crop.

### Fireblight.

As advised in recent monthly notes, a strict watch should be kept for any signs of fireblight infection, and all infected material should be promptly gathered and destroyed as soon as it is noticed.

### General.

The coming few weeks mark the commencement of the harvesting-season for many growers, and very shortly every one becomes busily engaged in picking, packing, and despatching the fruit to the markets.

No time should now be lost by those who have not yet done so in getting everything in readiness for the rush and bustle of the season, so that the season's work may commence without confusion. Where necessary, arrangements for labour should be made early to avoid disappointment.

As far as possible, fruit intended for the local markets should have reached a degree of ripeness which ensures the proper completion of the ripening process. Sound, full-flavoured fruit commends itself to the consumer, and, as a result of its quality, increases the demand. There is no doubt that the marketing of immature fruit, especially the export "reject," does incalculable harm. It must be remembered that the demand for fruit is made by the consumer, and that to increase the demand his desires for ripe, full-flavoured fruit must be met.

*—R. G. Hamilton, Orchard Instructor, Hamilton.*

### Citrus Notes.

Every effort during the coming months should be made to conserve the soil-moisture as much as possible. In the event of a dry spell being experienced, especially at the present time, the trees, where the land is insufficiently cultivated, are likely to suffer through want of moisture. Owing to the fact that many of the trees are still carrying a heavy crop of fruit any shortage of moisture is likely to have a detrimental effect on the setting of the next crop. On account of the low prices that have been ruling for lemons, growers have allowed much of the fruit which should have been harvested to remain upon the trees. The trees would benefit from an application of nitrogen in the form of sulphate of ammonia, applied at the rate of from 2 lb. to 4 lb. per tree, according to age and size, and this if worked into the soil would become almost immediately available.

Young trees are now showing a considerable amount of new growth; they should be carefully examined, and where an excess of growth has taken place some judicious pinching should be carried out. Any strong perpendicular shoots not required for the frame-work of the tree should be shortened back to induce side growth, while those shoots wanted to develop the framework may be lightly tipped to ensure stability.

Young borers are now active, and should be destroyed following the removal of the infected twig, which may be detected by the wilting of the

leaves. On larger limbs the castings show where borers are established. In this instance to kill the borers a few drops of benzine may be injected into the burrows, which should then be plugged with putty or soap.

Where necessary, a further spraying of Bordeaux mixture should be applied for the control of verrucosis and scab, and where thrips and scales are present it is advisable to apply nicotine sulphate and summer oil as advised in the November Notes.

*—L. Paynter, Orchard Instructor, Auckland.*

## POULTRY-KEEPING.

### Care of Growing Stock.

By this time all young stock should have passed the brooder stage, incubators should have been cleaned and disinfected, and brooders cleaned and put away for another season.

It is essential to keep the young birds growing, and every effort should be made to prevent any check in their development, the chief causes of which are over-crowding, insanitary quarters, and stale ground. Before moving young stock to fresh coops or houses, care should be taken to see that such quarters are thoroughly cleaned and disinfected. To do this work properly, first remove all perches, nest-boxes, and litter, in fact, everything movable, from the house, and if the floor is of earth, about 3 in. of the soil should be removed. The ceiling and walls should be swept down with a stiff broom, and then be thoroughly washed with a spray pump or garden hose, or with a scrubbing-brush, using plenty of water so that all dirt is removed from cracks and corners. Any accumulated dirt should be swept out.

Finally, it is advisable to give the walls, ceiling, and floor a good spraying with a strong solution of some good disinfectant, and if possible to leave the house for a day or two to dry. If perches are painted every ten days or so during the warm weather with waste car-oil or a mixture of two parts of waste car-oil and one of kerosene, there will not be much danger of insects infesting the young growing birds.

As the birds grow they require more perch-room, and it pays poultry-keepers to visit the roosting quarters regularly after the birds have gone to roost to make sure that they are not overcrowded. Overcrowding not only checks the desired development, but it is one, if not the chief cause, of autumn colds amongst growing stock. Adult birds require at least from 8 in. to 9 in. perch-room each.

The first sign of a cold is usually observed when dust collects round the nostrils, then, later on, comes sneezing with a watery discharge from the nostrils and eyes. Everything possible should be done to prevent even a slight cold from making its appearance, and if the roosting-quarters are visited regularly and care taken to see that plenty of perching-accommodation and ample ventilation are allowed, much will be done to prevent an outbreak of colds, which may turn to roup if neglected.

The grading of the growing birds regularly, and the culling-out of any weaklings (even pullets), will also go a long way towards assisting in the proper development of young stock. Feed for growing birds should be plain but of good quality, and the aim should be to build frame and bone but to avoid those substances that are likely to encourage prematurity.

A good growing mash may be made up of from 2 to 3 measures of pollard, according to quality, to one measure of bran, 3 per cent. of bone-flour, and one measure of finely cut succulent greenstuff, and the lot mixed with skim-milk. If no milk is available, about 5 per cent. of meat-meal may be added. A grain mixture of equal parts of wheat, barley, and a good short oat, should give good results. If growing stock are fed too much animal-food they usually come to maturity and start laying before they

are properly developed, with the result that small eggs are produced. Such pullets seldom lay for a very lengthy period, and never make desirable breeding-birds.

At times some poultry-keepers are inclined to more or less starve their pullets if they notice that they are coming on too quickly, but this policy does not lead to the best results, and it is far better to give the growing stock plenty of good plain food, and if they appear to be coming to maturity too quickly to reduce the amount of milk or meat-meal.

### Care of Late Chickens.

On many farms where the natural means of incubation have to be relied upon, it is not always possible to get chickens as early as desired. Where late chickens are being raised, it is well to make sure that they are reared on fresh clean ground and that the birds can get shelter from the hot sun. If no natural shelter is at hand, some artificial shelter should be erected by means of branches or sacks.

### Care of the Laying-hens.

A flock of good hens should give a 64-per-cent. production during December, and about 56 per cent. during January, or in other words 100 hens should lay on an average sixty-four eggs per day during December and fifty-six eggs per day during January.

The aim of all poultry-keepers should be to keep the hens laying till the pullets commence to lay. On some farms at the present time a few birds may be noticed to be drying up in the comb and even going into a moult. This is not unusual, but such birds should be culled, for they are usually weak specimens. However, when a large number stop laying and go into a moult during December or January, it is generally an indication that the stock are not getting sufficient feed. It is well to keep a close watch on the egg-yield, and if the number is not being produced look for the cause. Very often a little extra feed from now on, and a little extra skim-milk or animal-food will keep the hens laying well into the autumn. Where hens have been laying well for many months, special care should now be taken to see that they are given all the mash and grain that they require.

### Chick-sexing Examination.

The first New Zealand chick-sexing examination was conducted at the Wallaceville Poultry Station by the Department of Agriculture on 4th November.

Fifteen students undertook the examination, but only three were successful in qualifying for a second-class certificate. These were Mr. D. E. Hopkins, Otaki, who sexed 100 White Leghorn chickens in 18½ minutes, with an accuracy of 90 per cent.; Mr. W. H. Barnes, 7 Elizabeth Street, Wellington, who sexed 100 chickens in 20 minutes, with an accuracy of 90 per cent.; and Mr. H. C. Morton, 436 Esplanade, Island Bay, Wellington, who sexed 100 chickens in 18½ minutes, with an accuracy of 90 per cent. These students are to be congratulated and all will wish them success in the work they are undertaking.

The Department was prepared to issue certificates to those qualifying as under:—

(A) *First-class Certificate:* Those sexing 200 White Leghorn chickens in 30 minutes, with an accuracy of 95 per cent., without killing a chicken or causing injury.

(B) *Second-class Certificate:* Those sexing 100 White Leghorn chickens in 20 minutes, with an accuracy of 90 per cent. In the event of more than one chicken being killed, or more than three injured, the student will be disqualified.

### Export of Eggs.

The egg-export season for 1935 has now closed. A total of 11,915 cases of 30 dozen each was shipped from New Zealand to London.

The quantities from the respective centres were as follows: Auckland, 2,610 cases; Wellington, 191 cases; Canterbury, 6,366 cases; and Otago 2,748 cases. This shows an increase of 323 cases, or 9,690 dozen, over the number shipped during the 1934 season.

The Canterbury total of 6,366 cases, or 190,980 dozen, is not only a record for the province, but the largest number sent from any centre during any one season.

It is pleasing to note that the shipments are arriving in London in perfect condition.

*—C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

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## THE APIARY.

### Returning Swarms to Parent Colonies.

Swarms in January are of little value except as increase for next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the colony is cramped an extra super may be given, and with this inducement the colony usually settles down at once to work.

After-swarms always should be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queens can be picked out easily as they attempt to force their way through, and once these are removed the bees return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frame, when she will be accepted by the bees.

### Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air by day and night. All weeds and other obstructions should be removed from the front of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colony.

### Handling of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen allows his bees to loaf or cluster outside the hives for lack of storage room. It is well, when adding additional supers, to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work on the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not yet hatched—it is an excellent plan to tier up with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

### Use of Queen-excluders.

January is the month when queen-excluders are of most use to the bee-keeper, especially in South Island districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees sometimes attempt to raise queen-cells above the excluder. If this happens, the queen-cells should be destroyed, as the queens which emerge from them are not able to pass through the excluders to get mated, and in time develop into drone-layers. By providing the queen with plenty of empty combs she becomes able to continue laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells at once become filled with honey.

Queen-excluders are often condemned as being productive of over-swarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

*—E. A. Earp, Senior Apiary Instructor, Wellington.*

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## HORTICULTURE.

### Vegetable Crops.

THE uncommonly wet spring has been a severe test for many seedling crops. Where they have been sown thinly in clean land they generally have made good progress and all is well; but thick sowings, in weedy ground, after a few weeks of showery weather which prevented much work being done outside, now present a long expensive task which will increase the costs of production very considerably. The preparation of the land, especially for spring-sown crops, should include a period allowing for any weed-seeds near the surface sprouting and being destroyed by light cultivation before sowing down with crop-seeds of a known vitality, so that the sowing rates may be nicely adjusted. If quick advantage is then taken of dry intervals the work is comparatively light, even when such intervals are rare. The experience of the last few months has again shown us that good preparation is one of the big factors in successful cropping.

Among the crops maturing during the month of January are shallots, garlic, and autumn-sown onions. To obtain a bright sound sample dry weather is required while they are curing; if wet weather intervenes the process should be concluded in a good open shed.

During January the planting of winter crops of savoy, red cabbage, brussels sprouts, kale, broccoli, cauliflower, leeks, and celery should be completed, observing the methods and precautions mentioned in last month's notes.

Late crops which may be sown include peas, dwarf beans, short-horn carrots, globe beet, turnips, radish, parsley, winter spinach, silver beet, lettuce, and endive. These valuable crops for autumn and winter use should receive close attention. Much interest has been taken in mushroom-culture, especially the production of out-of-season crops in chambers where the conditions are under control. The local markets may not warrant extensive cropping of that kind, but at the present time mushroom spawn may be planted outside for producing a crop under natural conditions in localities where a sufficient supply of "wild" mushrooms are not usually found. The natural temperatures and humidity of the autumn months are generally suited to the crop. The bricks of spawn are broken into six or eight pieces about the size of a hen's egg and planted 1½ in. deep in fermented stable manure. They may be planted 9 in. or 10 in. apart in a disused hotbed, and the bed afterwards covered with 1 in. or 2 in. of light fresh soil passed through a riddle, and beaten down; or planting may be done in a well-drained paddock by removing a turf 1 ft. square; then 4 in. or 5 in. of soil, which is replaced by fermented stable manure, with one piece of spawn in the centre, firmly trodden down and the turf replaced and beaten down as firm as possible.

Considerable anxiety was caused in some localities by the dry weather last season, and it is necessary to be ready for such experiences. Vegetable crops, such as salads, especially celery, marrows, cucumbers, peas, and beans, deteriorate rapidly under dry conditions unless assistance is given. A very light mulch of lawn-mowings, or fermented stable manure, passed through a sieve, may be broadcasted on the surface of the ground after its preparation is completed and before planting the crop—or after sowing it. It will greatly improve the conservation of moisture and check the tendency of birds to dust themselves in a fine seed bed. Longer straw may be used between the rows of widely spaced growing crops. This mulch of humus goes a long way in conserving any moisture that may be available and preventing the serious damage done to crops by sudden changes in the amount of the water-supply.

In a dry season the late-potato crop should be moulded-up well to prevent the attack of potato-moth, *Phthorimaea operculella*, reaching tubers which may be otherwise near the surface On the other hand, in humid districts, or seasons, late blight is now a danger to this crop, and two or three applications of Bordeaux or Burgundy spray at intervals of two weeks to a month, according to weather conditions, should be made.

The tomato crop under glass in unheated houses will now be at the peak of the harvest, and attention to watering, ventilation, and feeding with liquid fertilizers will be the chief requirements. Except in stormy weather generous ventilation will usually be required, especially in the early morning. The crop outside will commence to ripen towards the end of the month of January; and, to protect it from the attack of diseases and pests, pruning and tying must be given prompt attention so that spraying may be done effectively. The larvæ of the stem-moth, *Gnorimoschema plaesiosema* which tunnel the base of the vine, and thrips carrying virus infection are the most likely pests in fine weather.

**Small Fruits.**

A surprising number of different kinds of fruits come under this heading—Raspberries, gooseberries, and currants; strawberries, Cape gooseberries, and the so-called cranberry (*Myrtus ugni*); Chinese gooseberry (*Actinidia chinensis*); loganberry and passion-fruit; tree tomatoes, guava, and *Feijoa sellowiana;* loquats (*Eriobotrya japonica*) and mulberries; with perhaps olives and figs. The three first-mentioned require to be grown in districts that have a climate which is distinctly cool; the remainder thrive best in the warmer localities, except the strawberries, which are perhaps the least particular so long as other conditions are suitable. The harvest periods of these fruits extend through all of the months of the year, with Chinese gooseberries and tree tomatoes ripening during the winter and loquats in spring, when strawberries follow on and lead in the summer-fruiting kinds, which are the most numerous. Most of these fruits have distinct commercial possibilities under the right conditions. Mulberries, however, are too perishable for shipment, and *Myrtus ugni*—here called a cranberry and elsewhere the Chilean guava—is more often grown as an ornamental shrub; but its aromatic fruits are edible, and a handful or so in an apple-pie give it a spiced flavour that is agreeable to most people. It is related to the tree which produces the cloves of commerce, and has sometimes been called *Eugenia ugni*.

Where commercial plantations of any of these fruits are to be made, the land should be taken in hand so soon as it is available and thoroughly prepared for planting during the autumn, winter, or spring, as the case may be. As these crops are perennial, and most of them have fibrous roots near the surface of the ground which prevent deep cultivation after establishment, it is necessary to eradicate completely any bad weeds, such as couch-grass, which may be present. The land should be cultivated deeply, and, especially in the case of land inclined to be poor, it should be enriched generously by turning in organic material to supply humus. Unsatisfactory crops are due chiefly to the presence of bad weeds or to maintaining the plantation when the plants are worn out and exhausted—a condition which is generally reached after a period of eight or ten years, if not before. Dry summer weather affords an excellent opportunity for cleaning the land, after which a good green crop or dressing of farm manure turned under will put the land into good heart for planting. So soon as planting is done, especially when it is in close order as with strawberries, the operation of implements is restricted; therefore the ground should be cleaned well before planting, when doing this is easier, cheaper, and more effective. Meanwhile definite plans for planting should be decided on and good plants located and ordered for delivery as soon as the season permits.

Plantations which have ceased to be profitable should be grubbed and burned or ploughed under as soon as the harvest is completed. At this season in many instances it would be advisable to plant a crop of broccoli, cauliflower, or a green crop to plough under later. Plantations which are to be continued are given what attention may be required. Raspberries and loganberries are pruned by removing all of the old growth which bore this season's crop. It is cut away at the surface of the ground, carried out, and burnt, treatment which is of the greatest service in pest-control when it is done thoroughly. Towards the end of January, when growth has ceased, black-currants also are pruned by cutting away the old wood, severing it just above a bud near the base. Where strawberries are to be carried on, old leaves and runners are removed and the plantation given such manurial dressing as may be necessary and light cultivation to put the plants into good condition, without making them soft and liable to suffer during the winter.

### The Homestead Garden.

The work of planning a garden to scale is a comparatively simple matter if the different features are dealt with in the right order. It is advisable to take a sheet of "graph" paper with the surface divided faintly into squares, ten to the inch; to call each square a foot and to work to a scale of 10 ft. to the inch. A ground-plan of the home should be drawn to scale; then an outline of the homestead section in its right relation to the house. Following on comes the service court, drive, and walks for access, which are placed in convenient positions for their purpose. All of these features are practically fixed in most instances and allow of little difference of opinion, as also does a fairly generous portion of land, more or less rectangular in shape, which is set aside as an enclosed garden for perennial crops such as asparagus, rhubarb, herbs, and small fruit only—an interesting and very useful feature. The remainder of the design now makes some demand on the imagination; much also depends on whether the land is flat or hilly, and the tastes and requirements of the household.

The larger area of ground usually lies to the north of the house, the direction of the noonday sun, and is sown down in lawn-grass and planted with a few specimen trees or shrubs, and so the house is kept open to the sunlight. The land to the south of the dwelling is usually occupied with shelter-trees or a plantation of a suitable size for the conditions. That to the east and west is bounded by shelter-hedges that are lower and furnished on the garden side with shrubberies which have a semi-shaded aspect which suits so many kinds of shrubs. Within this scheme a group of rose-beds and a herbaceous border may well find a place. These and other features, together with a variety of levels and situations, as well as extent, provide a field for designs of an infinite diversity. There is also the question of climate, which varies widely in rainfall and temperature, as well as soil. The planting to be most effective should be confined to plants which are absolutely characteristic of those conditions. This will give the work character and interest and get rid of the monotony which may and does sometimes creep into garden-planning.

The planting is planned by marking off the shrubbery border at intervals of 6 ft., making them sometimes 3 ft. towards the front of the border. These are about the average distances at which the larger and smaller shrubs respectively are set. Groups of these marks are surrounded by a line which also includes a number, which corresponds with a number against a plant in a numbered list of shrubs. In this way the number of plants of one kind in a group and their exact position are clearly indicated. Large trees may be numbered without grouping; and the herbaceous border in the plan may have the groups shown without the marks indicating the exact planting-position, as they vary widely. In this way borders on the plan are marked off into numbered groups, and trees and hedges shown on the plan are also numbered, the corresponding number in each case being placed before the name of a plant in the planting-list.

Large gardens are best planned and made by landscape architects who have had long experience of the work. In the moderate-sized garden, owners who are specially interested often desire to do the work themselves, but, in that case, after planning the work along the lines explained above, it would be advisable to submit it to an experienced person for well thought-out constructive criticism before proceeding with the work. The problem is comparatively simple in the case of the average small garden, in which, if planned and executed on the principles explained here, greatly improved results will generally be obtained.

*—W. C. Hyde, Horticulturist, Wellington.*

# ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison :—

| Year. | Number of Breeding-ewes. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. | Actual Number of Lambs tailed. |
|---|---|---|---|---|
| | | NORTH ISLAND. | | |
| 1935 .. | 9,697,231 | 83·68 | 8,114,361 | .. |
| 1934 .. | 9,524,065 | 88·70 | 8,447,643 | 8,555,477 |
| 1933 .. | 9,318,943 | 91·23 | 8,502,050 | 8,385,569 |
| 1932 .. | 9,170,996 | 89·16 | 8,177,657 | 7,988,569 |
| 1931 .. | 9,247,005 | 86·49 | 7,998,247 | 7,813,887 |
| 1930 .. | 9,312,461 | 83·19 | 7,747,274 | 7,710,370 |
| | | SOUTH ISLAND. | | |
| 1935 .. | 8,115,186 | 39·45 | 7,259,281 | .. |
| 1934 .. | 8,047,361 | 89·88 | 7,232,750 | 7,134,015 |
| 1933 .. | 7,890,756 | 88·14 | 6,955,252 | 6,889,128 |
| 1932 .. | 7,892,064 | 88·42 | 6,978,494 | 7,027,059 |
| 1931 .. | 8,361,724 | 87·13 | 7,285,914 | 7,161,104 |
| 1930 .. | 8,251,714 | 84·43 | 6,967,041 | 6,817,939 |
| | | DOMINION. | | |
| 1935 .. | 17,812,417 | 86·31 | 15,373,642 | .. |
| 1934 .. | 17,571,426 | 89·24 | 15,680,393 | 15,689,492 |
| 1933 .. | 17,209,697 | 89·82 | 15,457,302 | 15,274,697 |
| 1932 .. | 17,063,060 | 88·82 | 15,156,151 | 15,015,628 |
| 1931 .. | 17,608,729 | 86·79 | 15,284,161 | 14,974,991 |
| 1930 .. | 17,564,175 | 83·77 | 14,714,315 | 14,528,309 |

*District Estimates.*

The following table gives estimates of the current (1935) season's lambing for the several sheep districts :—

| Sheep District. | Number of Breeding-ewes. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. |
|---|---|---|---|
| Auckland .. .. .. | 1,990,732 | 81·22 | 1,616,884 |
| Gisborne - Hawke's Bay .. | 3,940,495 | 82·32 | 3,243,858 |
| Wellington - West Coast .. | 3,766,004 | 86·39 | 3,253,619 |
| Marlborough-Nelson-Westland | 786,122 | 78·41 | 616,324 |
| Canterbury-Kaikoura .. | 3,442,048 | 90·46 | 3,113,903 |
| Otago (including Southland) .. | 3,887,016 | 90·79 | 3,529,054 |
| Dominion .. .. | 17,812,417 | 86·31 | 15,373,642 |

—*Live-stock Division.*

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According to a report from the Instructor in Agriculture, Invercargill, three Southland farmers who last season grew trial areas of Mai turnip are pleased with it in respect to its resistance to club-root, but find that its yield is somewhat low.

# ANSWERS TO INQUIRIES.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

### TREATMENT OF LACERATED TEAT.

F. E. C., Otaki Railway :—

Barbed wire ripped a teat through to the milk channel from base to point. Though the teat was bound with sticking-plaster and a teat-syphon used milk oozed between the cut parts ; they have healed separately and the teat has opened out flat. Can anything be done while the animal is dry to make the wound heal together properly? The sphincter muscle at the point of the teat has been cut through, so that, even if the teat could be healed, probably milk would always be leaking away. Can anything be done to dry off the bad quarter altogether so that it will not produce milk ?

The Live-stock Division :—

As the injury to the teat in question has been a severe one, one cannot recommend any measures which are now likely to bring about a sufficient degree of repair to enable the teat to function in a satisfactory manner. Openings and leaking of milk from the quarter are liable to occur even after an operation has been performed. Moreover, the possibility of the quarter becoming affected with mammitis during or following the operation is considerable. Injections of alum and boracic powder in water will assist in drying off the quarter. It is difficult to prevent the quarter secreting milk when the cow flushes again, as to do so would practically mean the destruction of the secreting tissue of the quarter. The secretion may be controlled by the use of an astringent solution of alum and boracic powder, and the quarter may be eventually dried off. This should be your ultimate aim, so that the cow may be milked from three sound quarters.

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### STORAGE FOR BALED HAY.

A. A. M., Norsewood :—

What is the size of shed needed to hold the baled hay from about 6 acres ?

The Fields Division :—

On your country 6 acres of pasture should yield about twelve tons of hay. When baled this could be stored in a space about 10 ft. high, 12 ft. broad, and 20 ft. long. Generally it is considered unnecessary to provide weather-boarded sides on a building for this purpose, and the usual practice is to build what is known as a " Dutch barn." This consists simply of an iron roof supported on uprights, and for a shed of the above size six uprights should suffice.

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### SURFACE SOWING OF PASPALUM AND SUBTERRANEAN CLOVER ON BURN.

T. W. N., Bulls :—

I wish to establish paspalum and subterranean clover on a scrub burn on which the " take " of ordinary pasture has not been satisfactory. Would surface sowing on non-arable land be successful, and, if so, what is the best time for sowing for South Auckland District ?

The Fields Division :—

Surface sowing of paspalum and subterranean clover on non-arable land is quite successful provided there is plenty of ash remaining after the burn. It is probable, however, in your case that the ash has already disappeared, and if this is the case it is necessary to break up the surface of the ground by disking or hard harrowing.

The paspalum, to obtain the best results, should be sown in the spring, probably before the end of November. The following should be a suitable mixture to the acre : 10 lb. paspalum and 5 lb. subterranean clover. After sowing it is advisable to apply a dressing of 2 cwt. to 3 cwt. of superphosphate to the acre.

Provided the crust of the ground is broken, some establishment may be expected, but if the ground is hard or carrying anything of a fibrous mat of unburnt vegetation much success is not to be expected. In this latter case probably *Lotus major* should be included at the rate of 1 lb. to 2 lb. of the seed to the acre.

# WEATHER RECORDS: NOVEMBER, 1935.

Dominion Meteorological Office.

NOTES FOR NOVEMBER.

As a spring month November proved very disappointing, the outstanding meteorological features being its coldness, a deficiency of sunshine, and, in most districts, an excess of rainfall. Although there was fairly abundant growth, lambs did not fatten as well as might have been expected at this season of the year. In dairying districts the milk-yield was below normal. The constant showery conditions also interfered considerably with shearing operations. On the whole, however, stock kept in good condition, and the summer prospects for the farming community appear to be in every way propitious.

*Rainfall.*—The general rainfall exceeded the average over the greater part of the North Island, slight deficiencies being experienced in parts of the Auckland district and the Taranaki Bight only. The rainfall was above normal also over the eastern half of the South Island, but below in the western half.

*Temperatures.*—Temperatures were below the average over the whole Dominion, and, in fact, the November just passed proved, in many parts, to be one of the coldest on record.

*Pressure Systems.*—During the first week moderate to strong winds between north-west and south-west prevailed. The weather was rather changeable, and what rain fell was chiefly of a showery and scattered nature. On the night of the 6th, however, a strong southerly wind set in generally, accompanied by fairly widespread rain and a decided drop in temperature. A few high-level stations in the South Island at this time experienced falls of snow, while there were hail showers on parts of the eastern and southern coastal areas. Cold, squally conditions continued throughout the 7th and 8th.

On the 9th fine weather was experienced in most districts except in North Auckland, where strong westerly winds with showery conditions continued to prevail. On the 10th the weather became dull and threatening, with scattered rain, and during the night of the 11th widespread rain accompanied a southerly change. Cold, wintry-like conditions continued until the morning of the 14th, but an improvement was then setting in over most of the country, and, under the influence of a slight anticyclone, beautifully fine and warm weather prevailed on the 15th and 16th.

On the 17th dull, misty weather prevailed generally, rain developing in most districts, with fresh to strong north-easterly to northerly winds. During the night of the 17th heavy rain fell in many parts of the North Island and in the northern and west-coast districts of the South Island. Scattered falls occurred on the two following days, but by the morning of the 20th the weather had improved in the South Island. By the 21st the weather had become fine and pleasant generally, with milder temperatures.

By the night of the 23rd the front of a westerly depression had moved on to the Dominion, bringing scattered rain to western areas, and during the night of the 24th rain became more widespread, the wind turning to southerly in the South Island. This depression intensified when off the east coast, and on the 25th and 26th strong south-westerly winds blew in most parts of the country, the weather being particularly cold on the latter day, but in Westland it was mainly fine. Snow fell on many of the ranges of both Islands during the night of the 25th and on the 26th, and hail showers occurred in some of the coastal areas.

From the 27th to the close of the month the weather was generally fine, while an anticyclone moved slowly over the Dominion, but on the 30th dull, misty conditions prevailed in the Cook Strait area and on the west coast of the South Island.

RAINFALL FOR NOVEMBER, 1935, AT REPRESENTATIVE STATIONS.

| Station. | Total Fall. | Number of Wet Days. | Maximum Fall. | Average November Rainfall. | Total Rainfall to Date. | Average Rainfall to Date. |
|---|---|---|---|---|---|---|
| | | | *North Island.* | | | |
| | Inches. | | Inches. | Inches. | Inches. | Inches. |
| Kaitaia .. .. | 4·29 | 20 | 2·03 | 2·75 | 66·18 | 51·68 |
| Russell .. .. | 2·63 | 10 | 1·43 | 2·22 | 88·10 | 47·39 |
| Whangarei .. .. | 3·25 | 18 | 0·97 | 2·81 | 76·35 | 57·52 |
| Auckland .. .. | 3·43 | 19 | 1·05 | 3·59 | 58·14 | 46·17 |
| Hamilton .. .. | 4·15 | 21 | .. | 4·01 | 46·22 | 46·04 |
| Rotorua .. .. | 6·25 | 19 | 2·05 | 4·18 | 66·34 | 51·25 |
| Kawhia .. .. | 5·97 | 12 | 1·86 | 4·52 | .. | 50·42 |
| New Plymouth .. | 4·65 | 21 | 0·96 | 4·70 | 72·29 | 55·49 |
| Riversdale, Inglewood .. | 6·90 | 18 | 1·37 | 9·12 | 110·53 | 96·69 |
| Whangamomona .. | 7·04 | 18 | 1·51 | 7·39 | 82·35 | 71·92 |
| Hawera .. .. | 4·40 | 17 | 0·61 | 3·78 | 54·76 | 41·96 |
| Tairua .. .. | 2·61 | 12 | 1·16 | 3·63 | 69·72 | 60·07 |
| Tauranga .. .. | 3·37 | 19 | 1·03 | 3·29 | 60·56 | 48·81 |
| Maraehako Station, Opotiki | .. | .. | .. | 3·16 | .. | 50·45 |
| Gisborne .. .. | 4·54 | 16 | 1·22 | 2·88 | 45·61 | 42·83 |
| Taupo .. .. | 5·26 | 18 | 0·95 | 3·32 | 51·72 | 40·75 |
| Napier .. .. | 3·33 | 15 | 0·72 | 2·02 | 49·76 | 28·14 |
| Hastings .. .. | 2·63 | 16 | 0·40 | 1·82 | 38·76 | 29·98 |
| Whakarara Station .. | 5·26 | 17 | 0·85 | .. | 61·87 | .. |
| Taihape .. .. | 4·88 | 21 | 0·63 | 3.40 | 36·52 | 33·46 |
| Masterton .. .. | 4·04 | 14 | 0·90 | 2·69 | 44·04 | 35·47 |
| Patea .. .. | 5·68 | 22 | 1·37 | 4·01 | 55·37 | 41·29 |
| Wanganui .. .. | 3·03 | 16 | 0·72 | 3·24 | 41·45 | 33·42 |
| Foxton .. .. | 2·00 | 14 | 0·32 | 3·20 | 34·33 | 29·87 |
| Wellington .. .. | 2·84 | 18 | 0·58 | 2·99 | 37·65 | 39·37 |
| | | | *South Island.* | | | |
| Westport .. .. | 8·04 | 19 | 1·51 | 8·85 | 84·81 | 88·35 |
| Greymouth .. .. | 6·17 | 15 | 1·04 | 9·10 | 87·10 | 92·90 |
| Hokitika .. .. | 9·54 | 16 | 2·84 | 10·45 | 100·84 | 104·57 |
| Ross .. .. | 10·80 | 13 | 3·48 | 13·86 | 106·44 | 123·44 |
| Arthur's Pass .. | 7·71 | 13 | 3·51 | 16·11 | 116·68 | 147·80 |
| Okuru, South Westland | .. | .. | .. | 12·60 | .. | 133·50 |
| Collingwood .. .. | 9·08 | 13 | 4·66 | 6·90 | 97·46 | 89·19 |
| Nelson .. .. | 3·14 | 11 | 1·93 | 2·92 | 44·27 | 34·86 |
| Spring Creek, Blenheim | 2·59 | 13 | 1·25 | 2·39 | 27·30 | 28·18 |
| Seddon .. .. | 2·16 | 11 | 0·76 | 1·85 | 22·13 | 22·84 |
| Hanmer Springs .. | 6·12 | 20 | 1·46 | 3·46 | 42·15 | 41·29 |
| Highfield, Waiau .. | 4·68 | 16 | 1·00 | 2·52 | 31·69 | 30·64 |
| Gore Bay .. .. | 4·18 | 15 | 0·76 | 2·12 | 26·93 | 28·70 |
| Christchurch .. .. | 2·88 | 15 | 0·54 | 1·78 | 21·55 | 22·67 |
| Timaru .. .. | 3·48 | 14 | 0·57 | 1·95 | 19.29 | 20·26 |
| Lambrook Station, Fairlie | 3·50 | 12 | 0·89 | 1·93 | 20·81 | 22·30 |
| Benmore Station, Clearburn | 3·34 | 16 | 0·82 | 2·05 | 21·55 | 22·30 |
| Oamaru .. .. | 2·12 | 14 | 0·30 | 1·92 | 17·92 | 19·76 |
| Queenstown .. .. | .. | .. | .. | 2·71 | .. | 27·99 |
| Clyde .. .. | 1·04 | 9 | 0·29 | 1·34 | 13·63 | 13·46 |
| Dunedin .. .. | 3·78 | 18 | 0·63 | 3·21 | 33·69 | 33·18 |
| Wendon .. .. | 3·32 | 15 | 0·67 | 2·72 | 29·69 | 27·14 |
| Balclutha .. .. | 2·79 | 13 | 0·50 | 2·48 | 28·64 | 23·06 |
| Invercargill .. .. | 3·10 | 19 | 0·53 | 4·28 | 42·26 | 41·65 |
| Puysegur Point .. | 4·68 | 18 | 0·68 | 8·25 | 77·08 | 78·09 |
| Half-moon Bay .. | 2·87 | 16 | 0·72 | 5·79 | 53·67 | 53·89 |